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U. S. COMMISSION OF FISH AND FISHERIES,
GEORGE M. BOWERS, Commissioner.

PART XXV.

REPORT

OF

THE COMMISSIONER

FOR

THE YEAR ENDING JUNE 30, 1899

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
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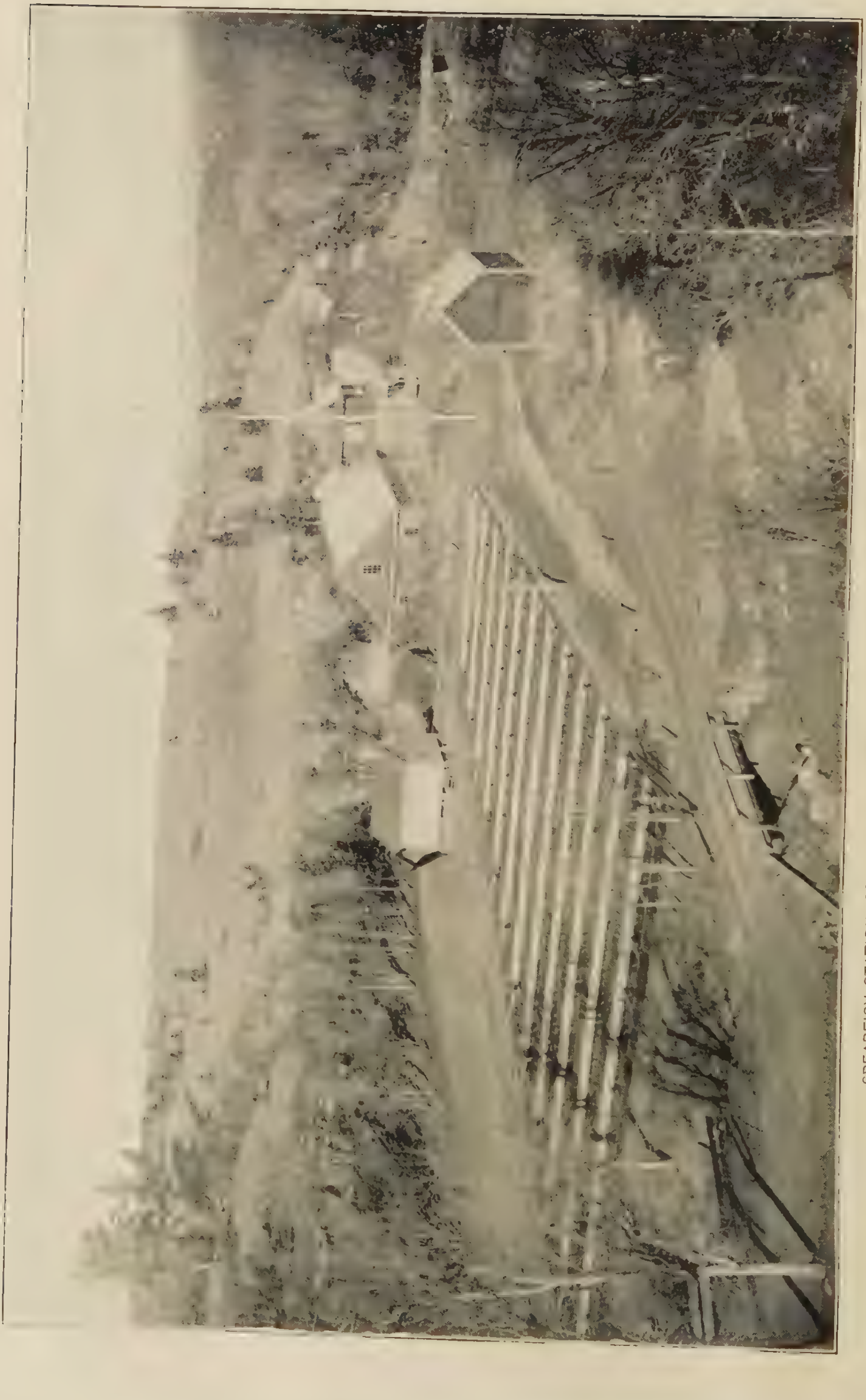


SPEARFISH STATION, SOUTH DAKOTA—SHOWING HATCHERY, ICE-HOUSE, AND REARING-PONDS.

REPORT

OF THE

UNITED STATES COMMISSIONER OF FISH AND FISHERIES

FOR THE

FISCAL YEAR ENDING JUNE 30, 1899.

I have the honor to submit herewith a report of the operations of the United States Commission of Fish and Fisheries for the fiscal year ending June 30, 1899, with appendices describing its special investigations and researches. Attention may be briefly drawn to the more salient features of the work of the year, detailed descriptions of which may be found in the accompanying reports of the different divisions of the Commission. First, however, a summary review of the status of the most important branches of the fisheries will be given.

GENERAL CONDITION OF THE FISHING INDUSTRY.

Through its agents and correspondents in every part of the United States, the Commission keeps in touch with the leading commercial fishing interests of the coast and interior; and inasmuch as its principal work is directed to the maintenance and improvement of these fisheries, by artificial propagation, by the publication of information showing the status and trend of the fisheries, by indicating to the fishing interests the means of developing the industry through improved apparatus and methods, and by pointing out the necessary measures for conserving the fishery resources, it is proper that the condition of the leading branches of the industry during the year 1899 be noticed in this report of the Commission's operations.

The approximate value of the commercial fisheries of the United States in 1899 was $40,000,000, of which the great ocean and coastal fisheries yielded $27,400,000, the river fisheries $8,600,000, and the Great Lakes and other interior fisheries $4,000,000. The fisheries for those species the supply of which the Commission is increasing by artificial means have a value of about $11,600,000. Owing to the recent decline in certain of the ocean and shore fisheries, more especially the fur-seal, whale, mackerel, and lobster, the aggregate value of our fisheries is about 10 or 11 per cent less than during the later years of the last decade and the early part of the present decade, when the maximum seems to have been attained.

Our leading fishery product, the oyster, worth about $14,000,000 annually, is readily susceptible of increase by methods of cultivation, and each season shows a larger proportion of the marketable output taken from planted grounds, thus insuring a permanent and increasing supply. Some of the States which have vital interests at stake are neglecting methods known to be beneficial and continue to depend largely on the natural supply, which is surely becoming exhausted, while other States are reaping important pecuniary returns from more advanced cultural methods. Without implying any criticism of the policy of particular States, attention may profitably be directed to a comparison of the present and past conditions of the oyster industry in the two principal oyster-producing areas, Chesapeake Bay and Long Island Sound. This comparison virtually covers the States of Maryland and Virginia, New York and Connecticut, whose oyster interests outside of those waters are relatively unimportant. Here the line between the different policies adopted in dealing with the oyster question is sharply drawn. In the Chesapeake region reliance now, as in the past, is placed on natural beds and restrictive measures, with little attention given to cultivation, while in Long Island Sound active and direct methods are practiced for increasing the supply and the natural beds are but a small factor.

The following suggestive table shows the oyster output of the four States named, in 1880, when all conducted the oyster industry on practically the same basis, and in recent years when the two regions had widely diverged in their methods. When one considers that the natural advantages possessed by Maryland and Virginia are greatly superior to those of New York and Connecticut, and that in the former States there are 40,000 oyster fishermen and in the latter less than 4,000, the significance of the comparison is accentuated.

States.	1880.		1897.		Percentage of increase or decrease.	
	Bushels.	Value.	Bushels.	Value.	Bushels.	Value.
Maryland	10, 600, 000	$4, 730, 476	7, 254, 934	$2, 885, 202	— 31. 6	— 39. 2
Virginia	6, 837, 240	2, 218, 376	7, 023, 848	2, 041, 683	+ 2. 7	— 7. 9
Total	17, 437, 240	6, 948, 852	14, 278, 782	4, 926, 885	— 18. 1	— 29. 1
Connecticut	336, 450	386, 450	2, 093, 909	1, 255, 741	+ 522. 3	+ 224. 9
New York	1, 043, 300	1, 577, 050	2, 215, 020	2, 141, 203	+ 112. 3	+ 35. 8
Total	1, 379, 750	1, 963, 500	4, 308, 929	3, 396, 944	+ 212. 8	+ 73. 0

NOTE.—An estimate for 1899, furnished by the New York shell-fish commissioner, shows a crop of nearly 4,000,000 bushels for that State.

The great ocean fisheries for cod, haddock, hake, and halibut, prosecuted on grounds adjacent to the New England coast and on banks lying to the eastward, are in a very satisfactory condition, the year 1899 being in some respects the most remarkable in their entire history. Perhaps the most noteworthy feature of these fisheries is the greatly increased quantity of cod landed in a fresh condition, from both the eastern banks and the grounds off the New England shore. Up to 1896 the salt cod was always in excess of the fresh cod; but since that year the reverse has been the case, and in 1899 the fresh fish exceeded the salt fish by 30 per cent, and the yield was more than double that of six years before. As shown in a statistical bulletin issued by the Commission, the quantity of so-called "ground fish" (i. e., cod, haddock, hake, cusk, pollock, and halibut) landed at Boston and Gloucester in

1899 by American fishing vessels was 155,367,808 pounds of fresh and salted fish, valued at $3,525,268, against 128,088,295 pounds, valued at $2,585,010, in the previous year.

There is unmistakable evidence of an increased abundance of cod in the inshore waters along the entire coast from Maine to New Jersey. This may, without hesitation, be attributed principally to the work of artificial propagation centering at the stations of the Commission at Gloucester and Woods Hole. A comparison of the yield of the shore cod fishery in the seven States of the North Atlantic seaboard in which this fishery is carried on shows a marked advance in Maine, Massachusetts, Rhode Island, and New Jersey between 1888 and 1898, and a general increase for the region from 28,450,000 pounds, valued at $665,000, in 1888 to over 43,000,000 pounds, worth $934,000, in 1898—50 per cent in quantity and 41 per cent in value.

The period of unprecedented scarcity of mackerel which began in 1886 has continued without intermission to the present time. The catch in 1899 was slightly larger than in the two preceding years, but less than in any other season since 1890. The leading feature of the fishery was the appearance of a large body of mackerel near Cape Cod late in the season, when some good fares were landed.

The decline in the lobster fishery continues in the centers of greatest production, and has been a subject of much solicitude on the part of the Commission, whose measures taken for increasing the supply are elsewhere referred to. Comparing the present output with the catch in 1880 (the earliest year for which authentic statistics are available), it appears that the yield has decreased 5,500,000 pounds, or 28 per cent. The height of this fishery seems to have been attained about 1889, when the catch was nearly 31,000,000 pounds, valued at $860,000. In 1899 the output was under 15,000,000 pounds, but the value was over $1,000,000. It is very important that the work done by the Fish Commission in increasing the lobster supply by artificial propagation be supplemented by the State authorities. While the lobster laws of the various States are commendable in principle, greater uniformity is desired and their more rigid enforcement is urgently demanded. During the past five years over 500,000,000 young lobsters have been artificially hatched by the Commission and planted on the east coast. As practically all the eggs from which these were produced would have been destroyed had not the Commission purchased the egg-bearing adults from the fishermen, it can hardly be doubted that these operations have had a decided influence on the supply, but they have not as yet seemed to arrest the decline, in the face of over-fishing and the destruction of short lobsters and brood lobsters carrying eggs.

Among the anadromous fishes, the shad and alewives have continued to be abundant along the entire east coast, notwithstanding that the fisheries are making larger and larger inroads each year. The supply of sturgeons is becoming less each season, and in some waters in which the fish formerly abounded practical extermination has occurred. The only stream in which a noteworthy run now exists is the Delaware. The protection and increase of these valuable fishes demand the most serious attention on the part of the State authorities, and their artificial propagation is being considered by the Commission. The supply has become so reduced that the collection of even a small number of eggs is difficult. The runs of striped bass, white perch, and yellow perch present no special features, although in the Potomac and some other rivers excessive fishing is beginning to have its effect on the perches. The increasing abundance of the striped bass in the waters of California may be noted.

The season of 1899 was one of the most noteworthy in the history of the Pacific salmon fishery. The pack of canned fish in the Columbia River was the smallest since 1873, with the single exception of 1889. The fall run of fish in the Sacramento was a failure. The catch in the shorter rivers of Oregon and Washington was, perhaps, an average one. In Puget Sound, on the other hand, all records were broken; nearly 900,000 cases of canned salmon were prepared (against 320,000 in the Columbia); and this region now ranks next to Alaska among the salmon-producing sections. In Alaska, also, the pack exceeded that of any previous year, aggregating considerably over a million cases. The total quantity of salmon canned in the United States waters of the Pacific coast was about 2,450,000 cases of 48 one-pound cans each (against 700,000 cases in British Columbia). The quantity of fresh fish represented by this pack, together with the catch salted or sold fresh, was not less than 175,000,000 pounds.

The important fisheries for white-fish, lake herring, lake trout, and pike perch in the Great Lakes are in a generally satisfactory condition. While unfavorable weather, and a close season, during a time when the largest catches are usually made, reduced the output from Michigan waters in 1899, the supply of white-fish in Lake Erie and the Detroit River was very large, and the catch was much in excess of that of any of the preceding ten or twelve years.

The fishery products imported by the United States annually are valued at upwards of $6,000,000. It is an interesting fact that a large part of this sum represents articles which are similar to or identical with products of our own waters, and which might just as well be purchased in the home markets. This does not refer to products which our fisheries do not yield in sufficient quantities to meet the demand, but to those of which our waters contain an abundance. The reason for seeking such products abroad is not difficult to determine. They are prepared by methods different from those in use in the United States, and are either superior in quality to the average home goods or have certain qualities which commend them to some of our people. The canned sardines of France, the pickled herring of Holland and Norway, and the cod-liver oil of Norway are well-known examples of these goods. Whatever excellence these may have is not due to any inherent property of the fish themselves but solely to the methods of preparation. It is certainly important that the United States fishermen and manufacturers adopt the best processes, and it would appear to be proper for the Government, as represented by this Commission, to undertake the necessary expert investigations with a view to inform our manufacturers as to the approved fishery methods of other countries.

The acquisition of new island territory having large fish-eating populations opens up important trade opportunities for the manufacturers of salted, smoked, and canned fish. Attention may be especially directed to Puerto Rico. where a recent examination of the Spanish customs records by agents of the Commission has shown that the value of the imports of fishery products during the last years of the Spanish régime was about $2,000,000 annually, of which less than $300,000 represented products from the United States and over $1,500,000 salt fish, chiefly cod, from the British North American provinces. Under proper regulations, there seems no reason why the trade may not be largely increased and pass under the control of our own people.

PROPAGATION OF FOOD-FISHES.

The increase in the appropriation by Congress for the propagation of food-fishes has resulted in an extension of the work, and the output for the fiscal year is greater than that of the previous season by about 198,000,000 fish. The total number distributed was 1,056,371,898, representing the important commercial fishes, such as cod, shad, white-fish, quinnat salmon, pike perch, lake trout, and lobsters.

On the Pacific coast collections of quinnat-salmon eggs were made as usual at Baird and Battle Creek, in the Sacramento River Valley, and on the Clackamas, Salmon, and Little White Salmon rivers, in the Columbia River basin. The experience this season varied from that of the past in the number of eggs secured in the different regions. At Baird runs of salmon were unusually good, and 16,568,600 eggs were taken, while at Battle Creek, where 48,000,000 eggs had been obtained the previous year, only 20,000,000 were secured this season, very few salmon entering Battle Creek on account of the low water. In the Columbia River basin the season was not as satisfactory as had been expected; but few salmon ascended the Little White Salmon or Clackamas rivers, consequently the take of eggs at these stations was below the normal, as will be seen by referring to the accompanying reports of the different stations. Notwithstanding the falling off in the number of eggs taken at some points, about 29,000,000 salmon fry were liberated in the valley of the Sacramento during the fall and winter, and over 12,800,000 in the basin of the Columbia.

The discontinuance of the Fort Gaston Station, from which the supply of steelhead-trout eggs had heretofore been obtained, necessitated the collection of these eggs from some other source, as the demand for this species has increased, owing largely to its successful introduction into the Great Lakes. A substation was accordingly established on the Willamette River, near Oregon City, where several hundred thousand eggs were obtained.

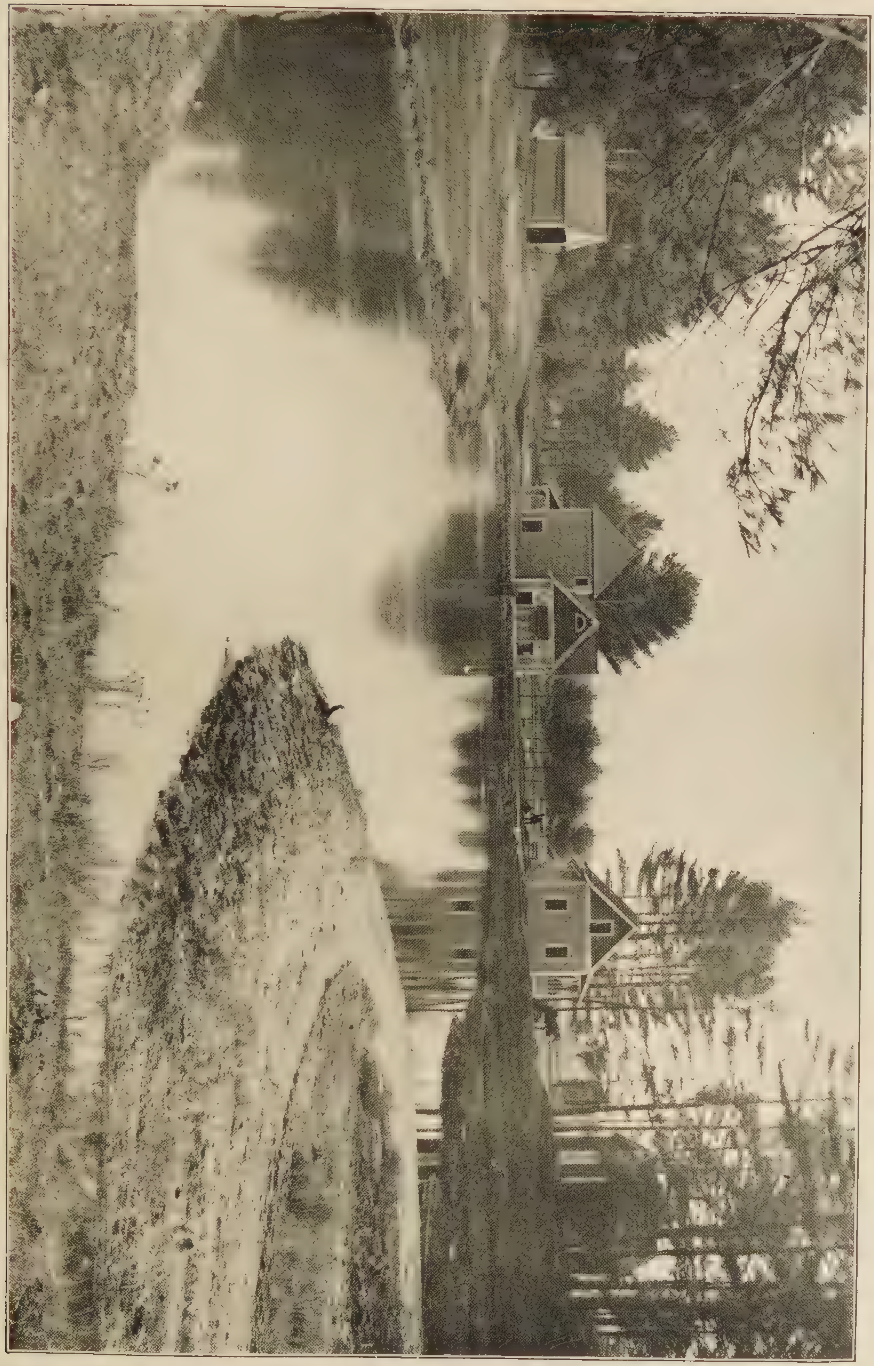
On the Great Lakes the collection of white-fish eggs from commercial fishermen was hampered by the operation of State laws, which prohibit the capture of white-fish during the spawning season in Lakes Michigan and Huron. A few million were taken in Lake Superior, but the conditions under which fishing is conducted in this lake are such that it is not possible to obtain many eggs, and the work was practically restricted to the station at Put-in Bay, Lake Erie. The experiments mentioned in the last report having demonstrated the practicability of holding adult white-fish in pens for spawning purposes, 12,785 fish were thus confined, and from them 102,051,000 eggs were obtained, which, with 83,403,000 secured from fishermen, made a total of 185,454,000, as against 112,842,000 for the previous year. From the success in obtaining eggs from penned fish this year it would seem that in the future the necessary supply can be readily obtained by impounding a sufficient number of white-fish early in each season. Most of these eggs were hatched as usual at Put-in Bay and liberated in Lake Erie, though the hatchery at Alpena, Mich., was filled and some millions were sent to the hatcheries at Duluth, Minn., and Cape Vincent, N. Y.

The lake-trout work in Lakes Superior, Michigan, and Huron was continued on the same lines as heretofore, but owing to the fact that the spawning fish did not appear on the spawning-grounds in Lakes Michigan and Huron until near the 1st of November, just before the close season commenced, the egg collections were much less than formerly. In Lake Superior efforts were more successful, 6,300,000 being obtained from the American and Canadian shore fisheries. As a result of the season's work over 9,500,000 fry were liberated.

The resumption of the propagation of pike perch the previous season met with such hearty commendation from all parts of the Great Lakes region that it was decided not only to increase the work on Lake Erie, but to undertake the collection of eggs in Michigan waters for filling the Alpena hatchery, and in Vermont and New York waters for the station at Cape Vincent. The experience gained in Saginaw Bay and on the Missisquoi River in Vermont has shown that several hundred million pike-perch eggs may be collected in these localities under more favorable conditions. In Lake Erie the number of eggs collected aggregated over 493,000,000. Of these, 87,862,000 were taken from fish which had been penned at Monroe Piers, Mich., and Put-in Bay. The application of this method did not prove as satisfactory with the pike perch as with the white-fish, as the conditions differed in many respects. The pike perch did not stand transportation as well, and unless stripped within 72 hours after being penned the eggs were usually valueless. The higher temperature of water in the spring, when the pike perch are penned, may be the reason for the smaller measure of success.

Work at the marine stations on the coast of Massachusetts was begun in the fall, the schooner *Grampus* being utilized during the months of October and November in collecting brood cod for the Woods Hole station. Field stations were established at Plymouth, Mass., and

PLATE II.



NASHUA STATION, NEW HAMPSHIRE—RESERVOIR, HATCHERY, WORKSHOP, AND ICE-HOUSE.

Kittery Point, Me., in November for the purpose of collecting cod eggs from the fishing vessels sailing from those ports. A total of 322,905,000 eggs was obtained, which produced 208,000,000 fry, which were planted on natural spawning-grounds along the coasts of Massachusetts, New Hampshire, and Maine.

On account of the meager number of eggs of the pollock taken in the past few years, but little attention was paid to the propagation of this species, though a few eggs were collected at Gloucester and hatched.

It had been determined to largely increase the output of flat-fish, but these plans were hampered by the lateness of the season, ice remaining in the harbors until late in February. As soon as the ice disappeared satisfactory collections of eggs were made in the vicinity of Woods Hole and East Greenwich, R. I., but from unexplained causes it was difficult to fertilize those first taken. Subsequently the method of fertilization was changed. As a result of the season's work, 52,441,000 fry were liberated in suitable waters in the vicinities from which the eggs were collected.

Early in March steps were taken to prepare for the lobster work along the coast of Maine. All of the dealers as far east as Rockland were visited, and arrangements were made with Mr. A. R. Nickerson, commissioner of sea and shore fisheries of the State of Maine, for the cooperation of the State officials in securing all egg-bearing lobsters captured during the spring. In the past considerable difficulty has been experienced in making the fishermen understand that they would be permitted to hold egg-bearing lobsters in live-cars, for the United States Fish Commission, as the State law provides that any person having in his possession egg lobsters would be subject to fine. Notices signed by the United States Fish Commissioner and State Commissioner Nickerson, advising the fishermen that they were authorized to hold live lobsters for this Commission, were distributed all along the coast, and the State deputy wardens were instructed not to molest anyone found with live female lobsters held for propagation. An effort was also made to secure a suitable site for the construction of a pound where a million or more young lobsters could be held until their fourth molting. A cove was needed covering several acres, and which could be so inclosed that the tide would ebb and flow daily through it, thus affording an abundance of natural food. After carefully considering many places, a location was selected in the vicinity of Vineyard Haven, but further investigation showed that the expense involved in proper equipment was more than could be met from the funds available, and accordingly the attempt had to be abandoned at that time.

The work of collecting egg lobsters commenced in April and continued until June 30 at Woods Hole, and until July 10 north of Cape Cod. All of the important fishing centers between Rockland, Me., and Newport, R. I., were visited at least once or twice a week by agents of the Commission, and 121,878,000 eggs were secured. These were hatched at Woods Hole and Gloucester and yielded 110,491,000 fry, 36,925,000 of which were planted along the coast of Maine at various localities selected by the commissioner of sea and shore fisheries, 33,685,000 above Cape Cod along the coast of Massachusetts, and the balance along the coast below the cape, as far south as Long Island Sound, Connecticut and Rhode Island. Although the plants already made have apparently had no appreciable effect upon the fishery, correspondents at various points report large numbers of young lobsters, varying from 2 to 4 inches in length, captured in traps or carried up on the beach in grass during heavy seas. Mr. W. D. Monroe writes that while at his home in Marblehead, immediately after a severe November storm, he observed hundreds of small lobsters on the beach in eelgrass; and that, although he had lived there for many years, he had never before seen such numbers of young lobsters in the vicinity, and thinks they are the product of the hatchery at Gloucester.

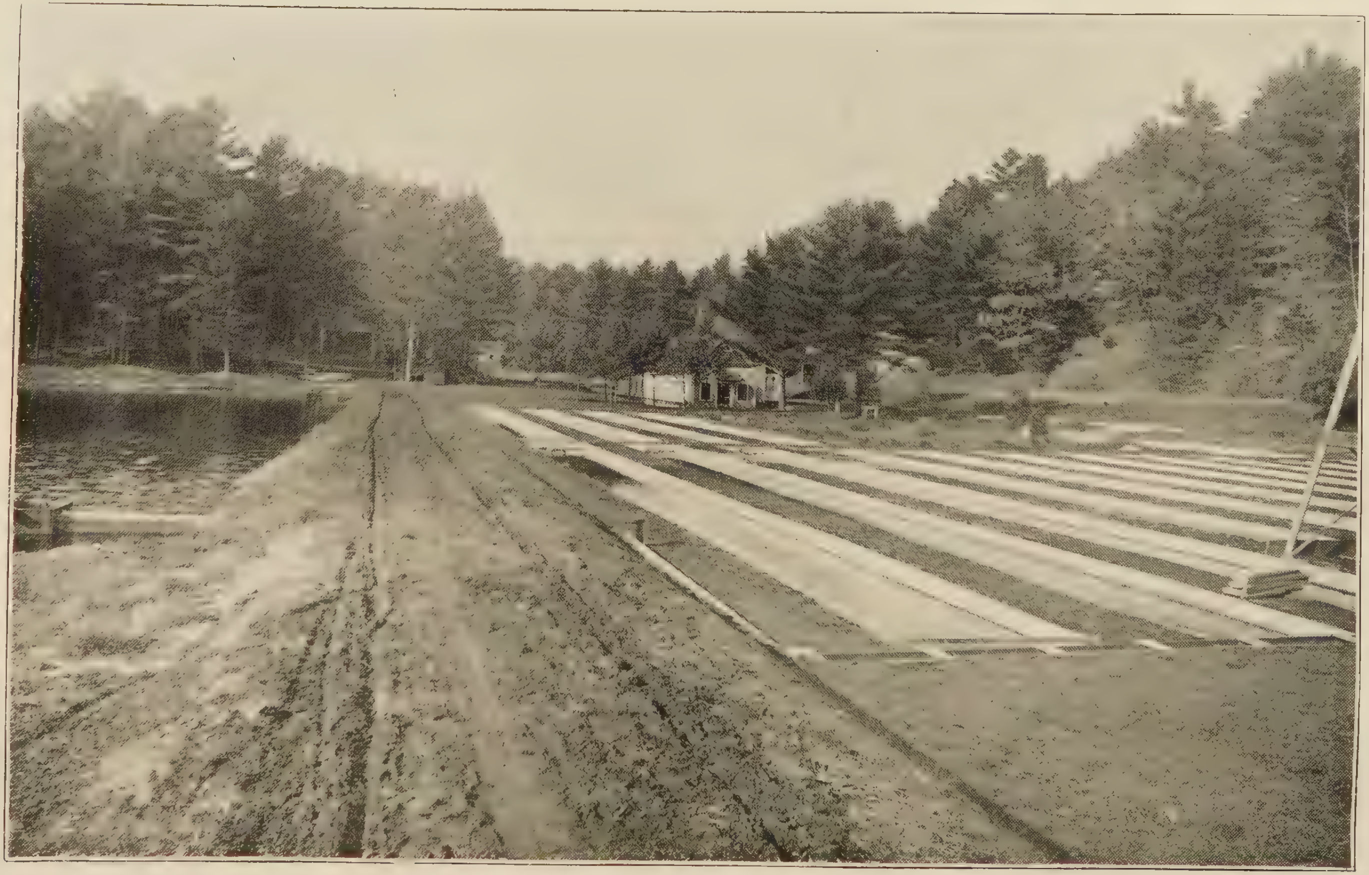
The season's shad operations were begun, as in former years, in Albemarle Sound, with the steamer *Fish Hawk* as a floating hatchery. Though this vessel was available for duty earlier than usual, owing to unfavorable weather it was the 5th of April before any ripe fish were secured. Egg-collecting was pushed vigorously until April 30, when the vessel proceeded to the Delaware River. During the month 21,000,000 eggs were hatched and the fry planted in North Carolina waters. Early in April shad-hatching commenced at Bryan Point on the Maryland shore of the Potomac River and at Havre de Grace on the Susquehanna, and on May 11 the *Fish Hawk* arrived in the Delaware, opposite Gloucester, N. J., and took up the work there. The results from all of these stations this season were satisfactory, enabling the Commission to plant over 235,000,000 fry, an increase over the previous year of more than 7,000,000. The importance of artificial propagation is fully realized by shad fishermen, and its effect on the fishery is the best illustration of the value of fish-culture. The catch of fish increases yearly, notwithstanding fewer fish ascend to their natural spawning-grounds at the headwaters of the various rivers, owing to the greater number of pound and gill nets.

At the inland stations there has been a steady increase in the output of brook trout, landlocked salmon, and the large-mouth black bass, which is particularly gratifying in view of the growing demand for these species throughout the country. As an instance of the success achieved in artificially extending the range of brook trout, it may be mentioned that at the Leadville Station, in Colorado, over 3,656,000 brook-trout eggs were collected during the fall from streams and lakes which had been stocked comparatively few years ago, this fish not being a native of this section of the United States.

The propagation of the grayling, which was undertaken the previous season at Red Rock Lake, Montana, was continued under better conditions, and 5,300,000 eggs were collected. Consignments of these were sent to Wyoming, Minnesota, Michigan, Rhode Island, and Vermont, in waters where it is hoped this fine food and game fish may be established.

Report U. S. F. C. 1899. (To face page XIV.)

PLATE III.



NASHUA STATION, NEW HAMPSHIRE—REARING-PONDS.

The following tables show the output of the various stations and the number of fish and eggs furnished to the States and Territories:

Statement of fish and eggs furnished for distribution by the stations of the United States Commission of Fish and Fisheries during the fiscal year ending June 30, 1899.

Source of supply.	Species.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Green Lake, Me	Golden trout		3, 074	
	Brook trout		196, 000	8, 800
	Lake trout	500, 000	399, 317	
	Black-spotted trout		8, 386	
	Steelhead trout			3, 767
	Landlocked salmon	82, 500		333, 157
Craig Brook, Me	Atlantic salmon	650, 000	450, 000	392, 280
	Landlocked salmon	110, 000	141, 875	159, 250
	Rainbow trout			23, 765
	Brook trout			1, 500
	Steelhead trout			26, 482
	Scotch sea trout			764
St. Johnsbury, Vt	Brook trout	230, 000	440, 000	4, 025
	Steelhead trout			3, 620
	Lake trout		15, 000	
	Quinnat salmon			147
	Landlocked salmon			6, 205
	Pike perch		250, 000	
Gloucester, Mass	Cod	9, 669, 000	106, 445, 000	
	Pollock		834, 000	
	Lobster		70, 610, 000	
Woods Hole, Mass	Cod		92, 143, 000	
	Flat-fish		52, 441, 000	
	Lobster		[a] 37, 853, 000	
Cape Vincent, N. Y	Brook trout		200, 000	
	Lake trout		425, 000	
	White-fish		5, 000, 000	
	Pike perch		9, 050, 000	
Steamer Fish Hawk	Shad	[b] 5, 965, 000	45, 623, 000	
Battery Station, Md	Shad	[c] 16, 430, 000	125, 596, 000	
Fish Lakes, D. C	Black bass, large-mouth			44, 465
	Black bass, small-mouth			150
	Crappie			3, 662
	Shad			3, 000, 000
Central Station, D. C	Rainbow trout		8, 143	[d] 112
	Brook trout		8, 000	[d] 10
	Lake trout		11, 128	
	Scotch sea trout			[d] 50
	Quinnat salmon			[d] 12
	Landlocked salmon			[d] 100
	Atlantic salmon		4, 225	[d] 95
	Yellow perch		30, 000	
	Shad		[e] 800, 000	
Bryan Point, Md	Shad	[f] 2, 401, 000	37, 381, 000	
Wytheville, Va	Rainbow trout	[g] 140, 000		460
	Quinnat salmon			1, 230
	Black bass			974
	Rock bass			1, 460
Erwin, Tenn	Rainbow trout			44, 800
	Brook trout			6, 700
Put-in Bay, Ohio	White-fish	216, 000	104, 930, 000	
	Pike perch		198, 540, 000	
Northville, Mich. [h]	Lake trout		2, 860, 000	190, 000
	Brook trout		669, 000	3, 600
	Loch Leven trout	8, 500		2, 000
	Steelhead trout			2, 500
	Rainbow trout		10, 000	
	Grayling		50, 000	
Alpena. Mich	White-fish	500, 000	28, 000, 000	
	Pike perch		25, 000, 000	
Duluth, Minn	Lake trout	650, 000	4, 335, 000	
	Brook trout		87, 308	
	White-fish		[i] 15, 300, 000	

[a] 2,028,000 eggs were also delivered to the laboratory at the station for experimental rearing.

[b] 1,710,000 eggs were also transferred to Battery Station, Md.

[c] 2,800,000 eggs were also transferred to Washington, D. C.

[d] These fish were taken from the aquaria of Central Station.

[e] 2,700.000 shad fry transferred to Fish Lakes rearing-ponds are not included in tabulation.

[f] Of these, 500,000 were lost on car No. 1, on trip to Atlanta, Ga.; 1,661,000 shad eggs were also transferred to Central Station for hatching.

[g] There were also transferred to U. S. Fish Commission stations 88,500 rainbow-trout eggs for hatching, and 1,500 to the Johns Hopkins University, Baltimore, Md.

[h] The Northville Station also shipped to Prof. Locy, at Chicago, for scientific purposes, 4,000 lake-trout eggs, 4,000 brook-trout eggs, and 3,000 Loch Leven trout eggs. There were also shipped to the Omaha Exposition 4,000 lake-trout yearlings, 600 brook-trout yearlings, 1,000 Loch Leven and 100 rainbow trout yearlings; also, 25 small-mouthed black bass.

[i] 500 white-fish eggs were shipped to the University of Chicago, for scientific purposes.

Statement of fish and eggs furnished for distribution—Continued.

Source of supply.	Species.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Quincy, Ill	Black bass			68, 452
	Crappie			9, 270
	Cat-fish			1, 250
Manchester, Iowa	Brook trout	3, 000	187, 000	59, 000
	Rainbow trout		15, 000	18, 000
	Lake trout		180, 000	400
	Grayling		22, 000	
	Black bass, large-mouth			685
	Black bass, small-mouth			26
	Rock bass			1, 183
Neosho, Mo	Rainbow trout	[a]35, 000		83, 964
	Black bass			16, 750
	Strawberry bass			310
	Rock bass			31, 516
San Marcos, Tex	Black bass			87, 975
	Crappie			1, 060
	Rock bass			3, 065
Leadville, Colo.[b]	Brook trout	105, 000	577, 000	293, 300
	Black-spotted trout	10, 000		78, 000
	Loch Leven trout		7, 000	17, 000
	Grayling		20, 000	
	Lake trout		10, 000	
Bozeman, Mont	Brook trout			19, 000
	Steelhead trout			20, 000
	Black-spotted trout	25, 000	106, 325	58, 000
	Grayling	[c]75, 000	4, 475, 000	
Baird, Cal	Quinnat salmon	[d]11,440, 500	3, 275, 110	
Battle Creek, Cal	Quinnat salmon	[e]16,189, 500		
Clackamas, Oreg	Quinnat salmon		7, 497, 831	
	Steelhead trout	[f]21, 000	8, 625	
Upper Clackamas, Oreg	Quinnat salmon		2, 930, 000	
Salmon River, Oreg	Quinnat salmon		650, 355	
Little White Salmon, Wash	Quinnat salmon		1, 791, 056	

[a] 90,800 rainbow-trout eggs also transferred to U. S. Fish Commission stations for batching.

[b] This station also transferred 380,000 brook-trout eggs and 10,000 rainbow-trout eggs to U. S. Fish Commission stations. There were transferred to Bozeman Station, 200,000 brook-trout fry and 780 2-year-old brook trout. 16,000 eggs of the black-spotted trout, and some few adult and yearlings of black-spotted, rainbow, and brook trout, were transferred to the Omaha Exposition.

[c] 305,000 grayling eggs transferred to U. S. Fish Commission stations. 10,000 black-spotted-trout eggs and 10,000 grayling eggs sent to Omaha Exposition are not included in tabulation.

[d] 35,000 quinnat salmon eggs sent to Omaha Exposition not accounted for in tabulation.

[e] 2,000,000 quinnat salmon eggs were transferred to Clackamas Station and 180,000 were delivered to Mr. Rutter for experimental purposes.

[f] 138,000 steelhead eggs were transferred to U. S. Fish Commission stations.

Summary of distribution.

Species.	Eggs.	Fry and fingerlings.	Adults and yearlings.	Total.
Shad	24, 296, 000	208, 311, 740	3, 000, 000	235, 607, 740
Quinnat salmon	27, 630, 000	16, 144, 352	1, 389	43, 775, 741
Atlantic salmon	650, 000	449, 225	392, 352	1, 491, 577
Landlocked salmon	192, 500	141, 875	497, 971	832, 346
Steelhead trout	21, 000	8, 625	56, 310	85, 935
Loch Leven trout	8, 500	7, 000	19, 000	34, 500
Rainbow trout	175, 000	33, 143	158, 831	366, 974
Black-spotted trout	35, 000	114, 711	135, 441	285, 152
Brook trout	338, 000	2, 354, 200	388, 583	3, 080, 783
Lake trout	1, 150, 000	8, 235, 045	190, 400	9, 575, 445
Scotch sea trout			814	814
Golden trout		3, 074		3, 074
Grayling	75, 000	4, 567, 000		4, 642, 000
White-fish	716, 000	152, 755, 000		153, 471, 000
Pike perch		232, 840, 000		232, 840, 000
Yellow perch		30, 000		30, 000
Cat-fish			1, 250	1, 250
Black bass (large-mouth)			208, 938	208, 938
Black bass (small-mouth)			186	186
Crappie			13, 941	13, 941
Rock bass			29, 192	29, 192
Strawberry bass			310	310
Cod	9, 669, 000	198, 588, 000		208, 257, 000
Pollock		834, 000		834, 000
Flat-fish		52, 441, 000		52, 441, 000
Lobster		108, 463, 000		108, 463, 000
Total	64, 956, 000	986, 320, 990	5, 094, 908	1,056,371,898

Résumé, by States and Territories, of the distribution and assignment of fish and eggs.

State or Territory.	Species.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Alabama	Rainbow trout			2, 400
	Black bass			3, 730
	Rock bass			365
Arizona	Black bass			150
	Rock bass			850
Arkansas	Rainbow trout			25, 155
	Black bass			1, 630
	Rock bass			100
California	Quinnat salmon	24, 978, 000	3, 275, 110	
	Landlocked salmon	20, 000		
	Lake trout	50, 000		
Colorado	Loch Leven trout		7, 000	17, 000
	Brook trout		500, 000	216, 300
	Black-spotted trout			63, 000
	Lake trout		10, 000	
	Grayling		20, 000	
	Black bass			550
Connecticut	Shad		9, 700, 000	
	Atlantic salmon	200, 000		
	Landlocked salmon	25, 000		2, 000
	Steelhead trout	21, 000		
	Loch Leven trout	8, 500		
	Rainbow trout	20, 000		
	Brook trout	25, 000	47, 975	1, 500
	Lake trout	200, 000		
	Black bass			950
	Crappie			100
	Lobster		5, 717, 000	
Delaware	Shad		22, 920, 000	
	Rainbow trout			500
	Black bass			600
	Crappie			300
District of Columbia	Shad			3, 000, 000
	Rainbow trout		3, 000	
	Yellow perch		30, 000	
Georgia	Shad	1, 901, 000	882, 433	
	Rainbow trout			2, 800
	Brook trout		4, 000	
	Black bass			5, 256
	Crappie			1, 947
Idaho	Rainbow trout	10, 000		
	Black-spotted trout		50, 000	
	Brook trout	20, 000	22, 500	25, 000
	Black bass			564
Illinois	Brook trout			200
	Cat-fish			1, 250
	Black bass			8, 080
	Crappie			2, 400
Indiana	Brook trout		24, 500	
	Lake trout		20, 000	
	Pike perch		6, 500, 000	
	Black bass			6, 515
	Crappie			1, 850
	Rock bass			200
Indian Territory	Rainbow trout			3, 175
	Black bass			585
	Rock bass			500
Iowa	Rainbow trout		15, 000	9, 000
	Brook trout		108, 630	53, 300
	Lake trout		180, 600	400
	Grayling		22, 000	
	Black bass, large-mouth			10, 720
	Black bass, small-mouth			26
	Rock bass			800
Kansas	Rainbow trout			1, 945
	Black bass			1, 711
	Rock bass			9, 000
Kentucky	Black bass			3, 065
	Crappie			1, 300
	Rock bass			275
Louisiana	Black bass			4, 242
	Rock bass			1, 800
Maine	Atlantic salmon		445, 000	392, 257
	Landlocked salmon	62, 500	141, 875	451, 682
	Steelhead trout			30, 195
	Rainbow trout			17, 257
	Black-spotted trout		8, 386	
	Brook trout		196, 000	8, 800
	Lake trout	500, 000	379, 317	
	Scotch sea trout			764
	Golden trout		3, 074	
	Lobster		33, 325, 000	
Maryland	Shad	10, 930, 000	86, 100, 000	
	Atlantic salmon		4, 225	
	Rainbow trout	25, 000	5, 143	5, 700

Résumé of the distribution and assignment of fish and eggs—Continued.

State or Territory.	Species.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Maryland	Brook trout		4,000	1,100
	Lake trout		11,128	
	Black bass, large-mouth			2,710
	Black bass, small-mouth			10
	Crappie			900
Massachusetts	Shad		870,000	
	Landlocked salmon	20,000		3,000
	Rainbow trout			2,000
	Brook trout		41,968	
	Lake trout		19,000	
	Black bass			1,250
	Cod	9,669,000	198,588,000	
	Pollock		834,000	
	Flat-fish		48,229,000	
	Lobster		62,004,000	
Michigan	Steelhead trout			2,500
	Loch Leven trout			2,000
	Rainbow trout		7,000	
	Brook trout		572,077	3,600
	Lake trout		4,660,000	175,000
	Grayling		50,000	
	White-fish		53,270,000	
	Pike perch		38,200,000	
	Black bass			2,200
	Rock bass			750
Minnesota	Brook trout		93,710	5,000
	Lake trout		1,470,000	
	Black bass			800
Mississippi	Black bass			4,470
	Crappie			260
	Rock bass			1,365
Missouri	Rainbow trout			35,124
	Brook trout	3,000		
	Black bass			6,850
	Crappie			100
	Rock bass			940
	Strawberry bass			310
Montana	Steelhead trout			19,995
	Black-spotted trout		56,325	59,941
	Brook trout	5,000		18,899
	Grayling		4,475,000	
Nebraska	Rainbow trout			10,000
	Brook trout		2,000	500
	Black bass			350
New Hampshire	Atlantic salmon	200,000		
	Landlocked salmon			7,000
	Rainbow trout	30,000		500
	Brook trout	25,000	8,000	225
	White-fish	216,000		
	Lobster		3,600,000	
New Jersey	Shad	2,200,000	21,911,000	
	Landlocked salmon	5,000		
	Rainbow trout			1,300
	Brook trout	20,000		1,900
	Black bass			2,250
New Mexico	Rainbow trout			3,860
	Black bass			600
	Rock bass			200
New York	Shad		11,470,000	
	Landlocked salmon	25,000		14,000
	Rainbow trout			500
	Brook trout	45,000	195,000	
	Lake trout	100,000	425,000	
	White-fish		5,000,000	
	Pike perch		7,000,000	
	Black bass			1,380
North Carolina	Shad		16,179,140	
	Rainbow trout			6,384
	Brook trout	20,000		
	Black bass			3,375
North Dakota	Brook trout		15,000	
	Lake trout		27,000	
Ohio	Rainbow trout		3,000	
	Brook trout		79,000	
	White-fish		86,860,000	
	Pike perch		178,840,000	
	Black bass			5,625
	Rock bass			200
Oklahoma	Rainbow trout			2,220
	Black bass			1,200
	Rock bass			900
Oregon	Quinnat salmon	2,002,000	11,078,186	
	Steelhead trout		8,625	
	Brook trout			11,000

Résumé of the distribution and assignment of fish and eggs—Continued.

State or Territory.	Species.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Pennsylvania	Shad	9,265,000	21,750,000	
	Atlantic salmon	250,000		
	Rainbow trout			1,798
	Brook trout	10,000		1,299
	Black bass			2,675
	Crappie			2,100
	Rock bass			1,200
Rhode Island	Landlocked salmon	20,000		
	Grayling	50,000		
	Black bass			500
	Flat-fish		4,212,000	
	Lobster		3,817,000	
South Carolina	Shad		1,974,167	
	Rainbow trout			800
	Black bass			1,775
South Dakota	Brook trout		50,000	17,250
	Lake trout		58,000	
	White-fish		125,000	
	Black bass			9,500
	Rock bass			25
Tennessee	Rainbow trout			11,501
	Brook trout			1,000
	Black bass			6,575
	Crappie			260
	Rock bass			1,238
Texas	Rainbow trout			940
	Black bass			87,045
	Crappie			1,024
	Rock bass			8,484
Utah	Landlocked salmon	5,000		
	Black-spotted trout			11,000
	Brook trout	30,000	11,000	
	Black bass			100
Vermont	Quinnat salmon			147
	Landlocked salmon	10,000		20,189
	Steelhead trout			3,620
	Rainbow trout			3,000
	Brook trout	25,000	341,872	3,800
	Lake trout	300,000	15,000	
	Pike perch		2,300,000	
	Black bass			500
Virginia	Shad		14,555,000	
	Quinnat salmon			1,242
	Atlantic salmon			95
	Landlocked salmon			100
	Rainbow trout			1,772
	Brook trout			10
	Scotch sea trout			50
	Black bass			10,825
	Crappie			250
Washington	Quinnat salmon	500,000	1,791,056	
	Black-spotted trout			1,500
	Brook trout			17,000
	Black bass			975
West Virginia	Rainbow trout			5,700
	Brook trout	20,000		900
	Black bass, large-mouth			6,850
	Black bass, small-mouth			150
	Crappie			1,150
Wisconsin	Rainbow trout			3,500
	Brook trout		36,968	
	Lake trout		720,000	15,000
	White-fish		6,000,000	
	Black bass			85
Wyoming	Rainbow trout	25,000		
	Black-spotted trout	25,000		
	Brook trout	50,000		
	Grayling	25,000		
	Black bass			125
Foreign Countries:				
Japan	Quinnat salmon	100,000		
France	Quinnat salmon	25,000		
	Rainbow trout	25,000		
New Zealand	Quinnat salmon	25,000		
	White-fish	500,000		
Ireland	Rainbow trout	10,000		
	Brook trout	20,000		
Portugal	Rainbow trout	10,000		
England	Rainbow trout	10,000		
	Brook trout	20,000		
Germany	Rainbow trout	10,000		
	Black-spotted trout	10,000		
Canada	Lake trout		240,000	
	White-fish		1,500,000	

During the year over 100,000,000 fish were handled on the four cars of the Commission, with a loss of a little over 1,250,000, or about 1.28 per cent. The cars traveled 95,374 miles in making this distribution. The remaining fish propagated were distributed by detached messengers and employees of the stations, who traveled 138,847 miles.

The railroads shown by the following list assisted the Commission very greatly by furnishing free transportation, without which the work would have necessarily been curtailed:

Table showing the amount of free transportation furnished by the railroads named during the fiscal year ending June 30, 1899.

Name of railroad.	Cars.	Messengers.
	Miles.	*Miles.*
Atchison, Topeka and Santa Fe Rwy	3,178	1,274
Austin and Northwestern R. R.		200
Baltimore and Ohio R. R	358	
Bangor and Aroostook R. R.	152	351
Bennington and Rutland Rwy		52
Boston and Maine R. R		2,420
Burlington and Missouri River R. R. in Nebraska.	1,303	
Burlington, Cedar Rapids and Northern Rwy	3,285	1,353
Central Vermont Rwy		620
Chesapeake and Ohio Rwy	599	
Chicago and Northwestern Rwy.	784	546
Chicago and West Michigan Rwy	1,701	42
Chicago, Burlington and Quincy R. R.	2,466	
Chicago, Milwaukee and St. Paul Rwy	452	
Chicago, St. Paul, Minneapolis and Omaha Rwy	392	
Cincinnati Northern R. R.		42
Cleveland, Cincinnati, Chicago and St. Louis Rwy	2,370	
Colorado Midland Rwy	1,176	83
Colorado and Southern Rwy	364	1,832
Delaware and Hudson R. R	475	
Denver and Rio Grande R. R.	1,488	4,578
Denver, Leadville and Gunnison Rwy		929
Detroit and Mackinac Rwy	3,004	524
Detroit, Grand Rapids and Western R. R.	1,049	
Detroit, Toledo and Milwaukee R. R	146	
Duluth, South Shore and Atlantic Rwy	2,295	
Erie R. R		394
Fitchburg R. R.		174
Flint and Pere Marquette R. R	4,452	1,406
Franklin and Megantic Rwy		50
Fort Worth and Rio Grande Rwy		284
Galveston, La Porte and Houston Rwy		14
Grand Rapids and Indiana Rwy.	680	157
Grand Trunk Rwy	68	
Great Northern Rwy	985	633
Green Bay and Western R. R.	132	
Gulf, Colorado and Santa Fe Rwy	736	102
Hoosac Tunnel and Wilmington R. R		48
Houston and Texas Central R. R.	592	166
Illinois Central R. R.	82	
International and Great Northern R. R.	853	728
Kansas City, Fort Scott and Memphis R. R	452	31
Kansas City, Pittsburg and Gulf R. R.	480	696
Maine Central R. R	2,488	44
Manistique Rwy	128	
Mattoon Rwy	18	
Michigan Central R. R.	8,170	410
Minneapolis, St. Paul and Sault Ste. Marie Rwy	252	
Missouri, Kansas and Texas Rwy		863
Mobile and Ohio R. R.	1,802	
Montana R. R.		240
Montpelier and Wells River R. R		168
Northern Pacific Rwy	1,579	243
Ohio River R. R.	121	
Oregon Railroad and Navigation Co	1,279	
Oregon Short Line R. R.	2,385	805
Portland and Rumford Falls Rwy	114	
Rio Grande Western Rwy	1,496	
Rumford Falls and Rangeley Lakes R. R.	56	
Rutland R. R		270
St. Louis Southwestern Rwy	418	750
San Antonio and Aransas Pass Rwy	415	426
Sandy River R. R		22
Southern Pacific Co.		326
St. Johnsbury and Lake Champlain R. R.		775
St. Louis and San Francisco R. R.	784	620
Texas and Pacific Rwy	2,519	3,404
Union Pacific R. R.	1,429	
Union Pacific, Denver and Gulf Rwy	597	192
Wabash R. R.	2,106	96
Wilmington and Northern R. R.		56
Wisconsin Central R. R.	92	
Total	59,797	29,439

NASHUA STATION, NEW HAMPSHIRE—HATCHERY EXTERIOR.

NASHUA STATION, NEW HAMPSHIRE—HATCHERY INTERIOR.

BIOLOGICAL INQUIRIES.

The work of the division of scientific inquiry has been of more than usual interest during the past year. Several important investigations have been inaugurated, and those already in progress have been completed or continued.

In July, 1898, a systematic survey of the biological and physical conditions of Lake Erie was begun and has been carried on with gratifying success. The commercial value of the fisheries of the Great Lakes and the magnitude of the fish-cultural operations necessary to maintain the supply of food-fishes make it important that all of the conditions which affect fish life be carefully studied, especially that future fish-cultural efforts may obtain the best results. The investigation was begun in Lake Erie, with headquarters at the station of the Commission at Put-in Bay, where the hatchery building could be used as a laboratory and the other facilities of the station, including a steam launch, could be utilized; furthermore, the region affords excellent natural advantages for pursuing the studies indicated. Prof. Jacob Reighard, of the University of Michigan, was placed in direct charge of the work, and was assisted by a corps of specialists, consisting of representatives from various institutions of learning and from the staff of the Commission. The summer was devoted to a study of the fishes and of the minute animals and plants which influence the movements and distribution of fishes, and the results were of such value that the investigation will be continued and its scope enlarged as much as possible.

The biological surveys of the interior waters of the Northwest have been continued under the direction of Dr. B. W. Evermann. The investigations during the season of 1898 chiefly concerned lakes Chelan, Kootenay, and Cœur d'Alene, and were, in a measure, preliminary to determining the advisability of more exhaustive inquiries in future. Lake Chelan, in the State of Washington, one of the largest bodies of fresh water west of the Mississippi, and Lake Kootenay, in British Columbia, are two important sources of the Columbia River. The investigations regarding them embraced a study of their general fish fauna, and were also for the purpose of determining the presence in their waters of the blueback salmon or red-fish in connection with the studies of the salmon in the Columbia River basin, which have been carried on for some years by the Commission. The fishes of Lake Chelan have never been studied, and, though it is known to contain 8 or 10 species, the red-fish probably does not occur in it. No satisfactory evidence could be found of the presence of the large red-fish in Lake Kootenay, but the small variety occurs in considerable numbers in the Kootenay system, and it is reported as spawning in streams in that region tributary to the Columbia. In Lake Cœur d'Alene, Idaho, it was desired to ascertain the results of plants of white-fish made by the Commission. No positive information was obtained, but the fishery resources of the lake are such as to warrant a further comprehensive study of its conditions.

In accordance with the policy of the Commission of making a study of the biological and physical conditions of important inland waters, an examination of the lake systems of Maine was begun by an inquiry embracing the Sebago Lake basin. The inland fisheries of this State are valuable and carefully fostered, and among its lakes Sebago, with its tributaries, holds an important place, both on account of its size and the considerable fish-cultural operations which have been carried on in its waters. The inquiry at this time appeared the more desirable on account of the apparent decrease of fish life, notwithstanding the extensive efforts made to maintain the supply. Several species of food and game fishes inhabit the lake, the most important being the landlocked salmon, and although this was the primary object of the inquiry, the other species received due attention. Interesting data in regard to the apparent decrease of the fish supply and bearing on the relation between the landlocked salmon (*Salmo salar sebago*) and the Atlantic salmon (*Salmo salar*) have been collected. The investigation was carried on by Dr. W. C. Kendall during July and August, 1898, and continued in May, 1899, and at the close of the fiscal year was still in progress. Besides Sebago Lake several smaller lakes and other waters in its extensive basin were examined.

For some time it has been held by citizens of Utah that certain useful marine animals might be advantageously acclimated in the waters of Great Salt Lake. While the salinity of the waters of the open lake was acknowledged to be too great for success in this direction, it was thought that in some of its bays, where rivers discharge, the density might be sufficiently low to permit the survival and growth of oysters, clams, crabs, and even fish. Accordingly, at the request of those interested, the Commission decided to undertake a study of the physical conditions of the lake in order to decide as to the feasibility of the project. The investigation was made by Dr. H. F. Moore, in September, 1898, and as shown in his comprehensive paper published as an appendix to this report (pp. 229–250) the question may be regarded as settled. It was found that while there is an ample food supply, yet owing to the limited and irregular character of the zone of mixed water, even at the mouths of rivers and streams, the attempt to stock the lake with any marine species would be useless, and any efforts to introduce shad or other anadromous fishes in the rivers would be equally unavailing.

An interesting inquiry into the utilization of the shells of fresh-water mussels in the manufacture of buttons has been made and a report on the subject published. While this industry has grown up within the last ten years, it has rapidly increased in value and importance, and if proper steps are taken to prevent needless depletion of the mussel beds it might well grow to larger proportions. The fishery has been exceedingly active and is carried on along about 200 miles of the Mississippi River in Iowa and Illinois, where the shoalness of the river makes nearly every part easily accessible, and the exhaustion of these beds, if present methods are continued, is a question of but a short time. In various streams other species of mussels than those now sought are known to exist, and these will probably be resorted to in the future. The industry has attained such proportions in the way of capital invested and labor employed that its destruction would be a calamity in many communities. It would seem very desirable, therefore, that the States interested enact legislation forbidding the gathering of small mussels, providing for a close season during spawning time, and preventing damage to the beds by sewage and factory refuse.

The experiments in fattening oysters have been continued at Lynnhaven River with interesting results. As it was found after a year's trial that oysters which had been planted in an inclosed pool did not fatten and were inferior to those growing on beds in the open rivers, an attempt was made to increase artificially the fertility of the water. The effort was encouraging, and it is believed that a continuation of the experiments will result in valuable improvements in oyster-culture.

An investigation, referred to elsewhere, of the waters of Narragansett Bay, was made with the steamer *Fish Hawk* in October and November, 1898, to study the distribution of star-fish in that body of water. It was found that this enemy of the oyster multiplies with great rapidity in certain localities, and from these breeding-grounds the young are distributed to the oyster-beds. It appears that these nurseries might be destroyed at small expense and that the oyster-grounds are probably free from invasion from beyond the limits of the bay. Supplemental to this work, observations were made of the general biological conditions prevailing in the bay and in Block Island Sound.

The study of salmon in the Sacramento River has been continued in a systematic manner, all portions of the river and the lakes at its source having been visited, seining stations established at regular intervals, and traps built. Thus the stream was kept under close observation and many facts ascertained regarding the natural history of salmon in this river. A full report on this work is being prepared and will soon be ready for publication.

An investigation has been undertaken looking to a better understanding of the natural history of the herring, particularly as to their migrations and spawning habits, a thorough knowledge of which is important from the value of the herring fisheries on the Maine coast.

Minor investigations have been made in the Wabash basin, in the San Pedro River, Arizona, and in the District of Columbia, together with interesting studies of the shad and mackerel.

A noteworthy event was the rediscovery of the tile-fish in considerable quantities and the definite location of its range. Since its apparent extinction in 1882, it has only been taken occasionally, but as the result of systematic cruising by the *Grampus*, in the summer of 1898, on the edge of the continental plateau south of southern New England and Long Island the fish was found in abundance and evidently breeding. As its range is close to the markets of the Atlantic coast it is not unlikely that a new marine fishery may yet be developed.

The laboratory of the Commission at Woods Hole, Mass., has been kept open during the entire year under the direction of Dr. H. C. Bumpus, of Brown University, and a large number of voluntary investigators have taken advantage of the opportunities offered. The equipment of the laboratory has been increased, collecting and other apparatus supplemented, a library established, and vessels and boats of the Commission have been utilized. While no restriction is placed on the lines of study pursued, in a majority of cases they bear, directly or indirectly, on economic problems related to the fisheries, and it is felt that the work carried on there has been not only of scientific interest and importance, but will also be of great practical value. Among the more important researches were a continuation of the experiments looking to the rearing of young lobsters, studies of fish parasites, and the habits of the star-fish, the ravages of which cause such loss to the oyster-beds. Observations were also made on the preservation of fish for market without the use of ice. Data were collected preliminary to undertaking the artificial propagation of the clam on a somewhat extensive scale, as it is believed that this very important shore fishery may thus be benefited.

It has been felt that a more complete knowledge of the habits, distribution, and abundance of the marine food-fishes in the coastal waters of the South Atlantic States and of the non-economic fishes and other animals related to the food-fishes, as food, enemies, etc., is highly desirable from scientific, economic, and fish-cultural standpoints. It was therefore decided to establish a biological station and laboratory at some point where work could be carried on by volunteer investigators, as at Woods Hole. The plan met with the indorsement and encouragement of those interested in the development of the fisheries of the South, and after due consideration Beaufort, N. C., was selected as the most available place, the advantages of the locality having been shown by experience. The waters are full of animal life and the region is favorable for a study of the biological conditions of the southern coast in general. Accordingly, a building was rented, equipment provided, and on June 1, 1899, the laboratory was opened under the direction of Dr. H. V. Wilson, of the University of North Carolina.

STATISTICS OF THE FISHERIES.

A canvass of the fisheries of the coast and tide waters of the Middle Atlantic States has been completed, covering the statistics for the calendar year 1897, the details of which are shown hereafter in the division report. It was found that the fisheries of these States have decreased in aggregate value $4,701,051 since the last canvass was made in 1891, chiefly owing to the falling off in the oyster industry in Maryland and Virginia, although this fishery is still by far the most important of the region, being worth $8,877,824 while the total shad fishery, which ranks next, is valued at $980,977. The fisheries for alewives, menhaden, and crabs vary in value from $229,000 to $471,000, and the blue-fish fishery is worth over $580,000. The total fisheries of these States were worth, respectively: New York, $3,401,190; New Jersey, $3,614,434; Pennsylvania, $269,507; Delaware, $252,123; Maryland, $3,617,306; Virginia, $3,167,863. They represent an investment of $15,188,614, and employ 95,316 persons.

Monthly statistics of the yield and value of the more important fisheries which find a market at the port of San Francisco have been collected, and for the calendar year 1898 they have aggregated more than 39,500,000 pounds, valued at over $7,330,000. This includes the whale fishery and most of the Alaskan salmon fisheries, as well as certain ones of Oregon and Washington. The item of greatest importance is the salmon fishery, valued at nearly $5,250,000. The growth of the oyster industry of San Francisco Bay, based on transplanted eastern oysters, is of interest, the quantity marketed in 1898 being valued at $482,000. It was found that the sea-otter fishery, prosecuted off the coast of Alaska, is rapidly declining, only 154 skins having been entered at the custom-house during the year. It may be noted that the whale fishery experienced a revival in 1898, the value of its products being materially increased by an unusual capture of bowhead whales in the Arctic Ocean by the Pacific whaling fleet.

The total quantity of fishery products landed at the ports of Boston and Gloucester in 1898 was 143,403,740 pounds, valued at $2,989,088, an increase over the preceding year of 16,538,142 pounds, worth $110,453. This increase must be entirely credited to Gloucester, the receipts at Boston showing a decrease, as compared with 1897, of 8,224,000 pounds. Interesting tables, illustrating in detail the fisheries conducted from these two ports, are published hereafter.

An agent of the division accompanied the *Fish Hawk* to Puerto Rico, where his investigations developed interesting information regarding the commercial aspects of the fisheries in that island, as mentioned in the paragraph relating to that expedition.

An inspection of the Pribilof seal rookeries was made by Mr. Charles H. Townsend during July and August, 1898, in order to report to the Treasury Department, as required by law, on the condition of the fur-seal herd. It was found that the herd had decreased some 22 per cent since the count of 1897. During the year the number of surplus male seals killed on the islands, under the supervision of the United States Government, was 18,032, and the pelagic catch made by 35 Canadian vessels from the American herd was 28,142.

THE STEAMER FISH HAWK.

This vessel was returned to the Commission by the Navy Department September 15, 1898, and on September 29 Lieut. Commander Richard G. Davenport, U. S. N., under orders from the Navy Department, assumed command. Some alteration and refitting were necessary after her use as a gunboat, and October 18 she was again ready for Fish Commission work. Soon after a special investigation of Narragansett Bay, mentioned elsewhere, was undertaken at the request of the Rhode Island commissioners of inland fisheries, and was completed November 17. Shortly thereafter preparations were begun to fit the vessel for a scientific expedition to Puerto Rico. When this island became a possession of the United States little was actually known of the animal life in its waters; but it was believed that many species of food-fishes and other edible aquatic animals existed there, and it was felt that a knowledge of these, of the commercial fisheries, and the fish trade would prove of both scientific interest and economic value. The establishment of new business and social relations between Puerto Rico and the United States and the consequent changes in the industries of the island made it desirable that the conditions be studied before considerable modifications should take place. It was therefore decided to send the *Fish Hawk* to Puerto Rico with a party to study the subject.

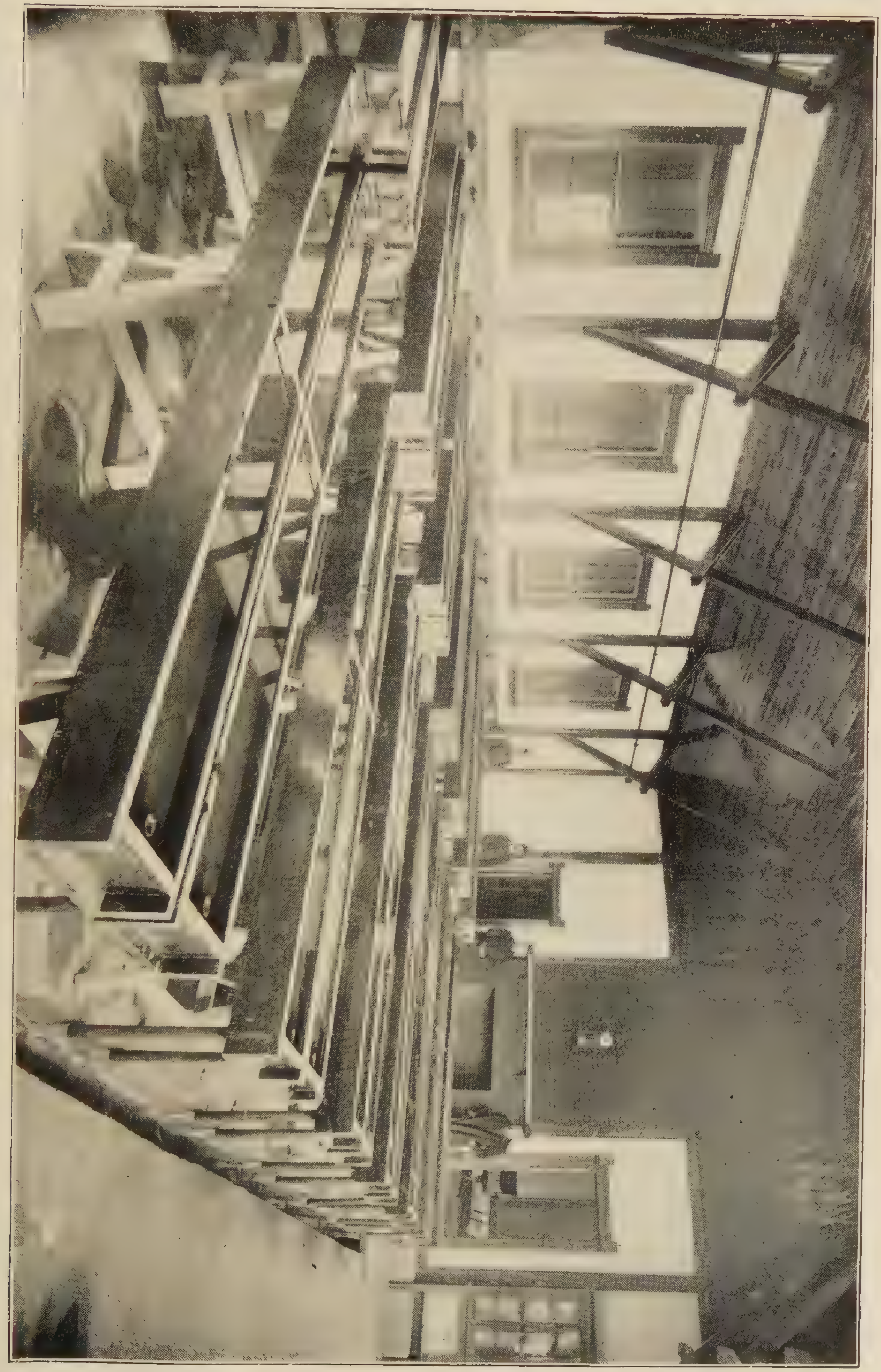
The scientific investigations were under the immediate direction of Dr. Barton W. Evermann, of the division of scientific inquiry, who had the aid of a full corps of assistants. The vessel sailed from Norfolk on December 17 and arrived at San Juan January 2. The investigations were immediately begun at this port and extended entirely around the island, stops being made at the principal places. Though the shortness of the time during which the *Fish Hawk* could be retained on this work prevented the investigation from being complete and thorough, extensive collections were made and valuable information obtained. A general report embodying the results of the expedition will be issued, as soon as practicable, in the Bulletin of the Commission for 1900.

The results of the commercial inquiries have already been published as an appendix to this report, pages 1-34. Many species of edible fishes are found and fishing for local consumption is conducted about most parts of the island, though not very actively, most of the fish used being brought from Nova Scotia and Newfoundland. 34,156,000 pounds, valued at about $2,124,000, were imported in 1897, of which over 28,000,000 pounds came from the British possessions and less than 5,000,000 pounds from the United States. Most of these fish were either dried, pickled, or canned. With improved methods of transportation and refrigeration it is thought that the local fisheries might be greatly increased in quantity and value.

The work of the party was aided by the military and naval authorities in the island, the governor-general, Maj. Gen. Guy V. Henry, directing that every facility be granted to Lieut. Commander Davenport and Dr. Evermann.

In order to take up the usual shad-hatching work in Albemarle Sound, the *Fish Hawk* left Puerto Rico February 22, arrived at Norfolk, Va., on March 8, and at Edenton, N. C., on March 15. From this date till June 12 the vessel was engaged in shad operations in Albemarle Sound and the Delaware River, when it proceeded to Woods Hole, Mass., and there remained until the close of the fiscal year, in connection with the scientific work carried on at that station. During the year this vessel was more extensively engaged at sea than usual, having steamed

PLATE V.



SPEARFISH STATION, SOUTH DAKOTA—HATCHERY INTERIOR.

over 7,000 miles. While engaged in scientific work her deep-sea dredges, trawls, and other appliances were almost constantly in use.

On March 18 Lieutenant-Commander Davenport was detached from the vessel at his own request, and though he had only been in command five months it is felt that the Commission has lost the services of a faithful and efficient officer. On the same date he was succeeded by Mate James A. Smith, U. S. N.

REPAIRS TO STEAMER ALBATROSS.

The *Albatross* was detailed by the President to the Navy Department April 13, 1898, as an auxiliary cruiser during the war with Spain and was returned to the Commission August 25, 1898. This vessel had been in commission since 1883 and was in need of considerable repairs and alterations besides new boilers, her present ones being nearly worn out and unserviceable. Accordingly, under authority of an act of Congress approved July 1, 1898, plans for the boilers were prepared, contracts let, and the work of repairing was taken up as soon as possible, but owing to delays in the completion of the boilers, the ship was not ready for sea till the close of the fiscal year. The boilers are of the Scotch marine type 10¼ feet long by 12 feet greatest diameter. The principal alterations were raising the pilot house, thereby permitting the construction of two new staterooms underneath and an upper bridge on top, and the enlargement of the coal-bunkers to provide additional storage for 70 tons of coal. A new dynamo and engine were provided, the main engines and the machinery overhauled and repaired, the quarters of officers and crew refitted, the hull of the vessel inspected and scaled wherever necessary, and many other minor but essential improvements made. This work has been done under the immediate supervision of the commanding officer, Commander Jeff. F. Moser, U. S. N., and he reports that the hull and appurtenances of the vessel are now in first-class condition and that her general efficiency is greatly increased. By the addition to the coal-bunkers her steaming radius is extended 1,300 or 1,400 miles, and with the new staterooms the scientific parties carried can be more comfortably accommodated.

NEW STATIONS.

The new stations at Spearfish, S. Dak., and Nashua, N. H., for which sites were acquired during the past fiscal year, and at Erwin, Tenn., where construction work was in progress, are designed primarily for the propagation of the salmonidæ, though the basses also are to receive attention at Erwin. At Spearfish a frame hatchery 32⅔ by 65½ feet has been erected. The building is on a stone foundation, is heated by steam, and contains a hatching-room, office, reception-hall, and boiler-room, with two bed-rooms in the upper story. The hatching-room contains 32 troughs, 13 feet by 12¾ inches, fitted with the usual trays, which afford facilities for handling about 1,000,000 eggs. The water supply is obtained from springs, and is conducted into the building by gravity. 12 rearing-ponds 100 by 8 feet, 3 spawning-ponds 120 by 20 feet, 2 spawning-ponds 84 by 20 feet, all 3 feet deep, have been completed, besides 3 stock-ponds, aggregating 15,000 square feet. To protect these ponds from floods it was necessary to excavate an 800-foot channel, 10 feet wide and 6 feet deep, to carry off water from a gulch located above them. An ice-house, 20 feet by 14 feet, has been built, and the necessary walks and roadways have been completed and the property fenced with wire.

At Nashua a hatchery similar in construction to the one at Spearfish has been erected. The building is 100 by 18 feet, and is equipped with 40 troughs 12½ feet by 12¾ inches, with a capacity for handling 1,000,000 eggs. Two other buildings have been erected; one a frame structure 34 by 18 feet, on post foundations and containing a carpenter-shop, fuel-room, and refrigerator, the other an ice-house 20 by 14 feet, affording storage for 30 tons of ice. There have been completed 14 rearing-ponds 100 by 8 feet by 2 feet deep, 3 spawning-ponds 64 by 36 feet, and 2 spawning-ponds 70 by 48 feet, all 3 feet deep, and 2 stock-ponds, one about ½ acre and the other 1½ acres in extent.

The hatchery and ponds are supplied with water flowing naturally from springs above them, and these springs can be supplemented in dry weather, if necessary, with ample water from a dozen driven wells on the premises. The grounds have been graded and the necessary roadways and walks completed and the reservation surrounded with a fence.

The development of the Erwin station has been continued, and there have been erected—besides the hatchery and superintendent's dwelling mentioned in the last report—a foreman's house, barn, ice-house, and fuel-house. The hatchery is a frame building 100 by 18 feet, equipped with 34 troughs 12¼ feet by 12¾ inches, with a capacity for about 1,000,000 eggs. The superintendent's dwelling is a two-story frame cottage 27 by 36 feet, and contains 6 rooms. The foreman's dwelling contains 5 rooms, and is a frame structure 50 by 38 feet. The barn, 20 by 30 feet, has 2 stalls and wagon room; and the ice-house, 20 by 14 feet, has storage capacity for 30 tons of ice. There are now completed 6 spawning-ponds 100 by 10 feet, 5 feet deep; 2 spawning-ponds 100 by 50 feet, and 2½ feet deep; 24 rearing-ponds 50 by 12 feet and 2 feet deep, and 4 stock ponds with an aggregate area of 30,155 square feet. The water supply is derived from a spring, and is led to the hatchery and ponds by gravity. As no railroad station is near, a siding has been built for convenience in handling shipments of fish. The grounds have been surrounded with a substantial wire fence.

An act of Congress approved July 1, 1898, directed the establishment of fish-cultural stations in the States of Georgia and Washington, in both cases providing that the land should be donated to the Government.

In Georgia the location near Bullochville, in Meriwether County, described in the last annual report, being satisfactory, negotiations were entered into with the owners, and on February 14, 1899, 18.97 acres were given to the United States by Messrs. Benjamin F. and Cyprian

Bulloch and Mrs. Sarah J. Bussey, the deed containing a proviso that the land should revert to the owners in case of its abandonment as a fish-cultural station. The preparation of plans was promptly taken up and at the end of the year the development of the station had begun.

The station in the State of Washington being intended for propagating the blueback or sockeye salmon, it has been deemed advisable to locate the hatchery at Baker Lake, where extensive spawning-grounds of this species are known to exist, as noted in the last report. Baker Lake is in what is known as the Washington Forest Reserve and is the head of Baker River, its outlet, about 16 miles above where the latter empties into the Skagit River and about 35 miles by trail northeast from the town of Hamilton. The lake is about 1½ miles long by 1⅓ miles wide. The point selected for the hatchery is near the center of the south shore of the lake, where a State hatchery has been operated for a number of years. By a proclamation of the President, dated May 10, 1899, the lake and surrounding lands within half a mile of its shore were set apart for the use of this Commission for fish-cultural purposes. The State hatchery and equipment have been purchased, and preparations for operating the station were at once begun.

Battle Creek Station, California, had been operated since the season of 1896 under an arrangement made with the California State Commission, and as it afforded exceptional opportunities for the collection of salmon eggs its acquisition by the Government has been deemed of importance. An act of Congress approved January 28, 1898, authorized the establishment of a permanent station at this point. Owing to difficulty in obtaining a valid title to the land, the purchase was not completed till March 25, 1899. The buildings and equipment of the California Commission have been purchased, and the station is now in condition for continued operation. It is on the east bank of Battle Creek, in Tehama County, about 12 miles east of the town of Anderson. The hatchery buildings are described in the appendix to the report for 1897, page 24.

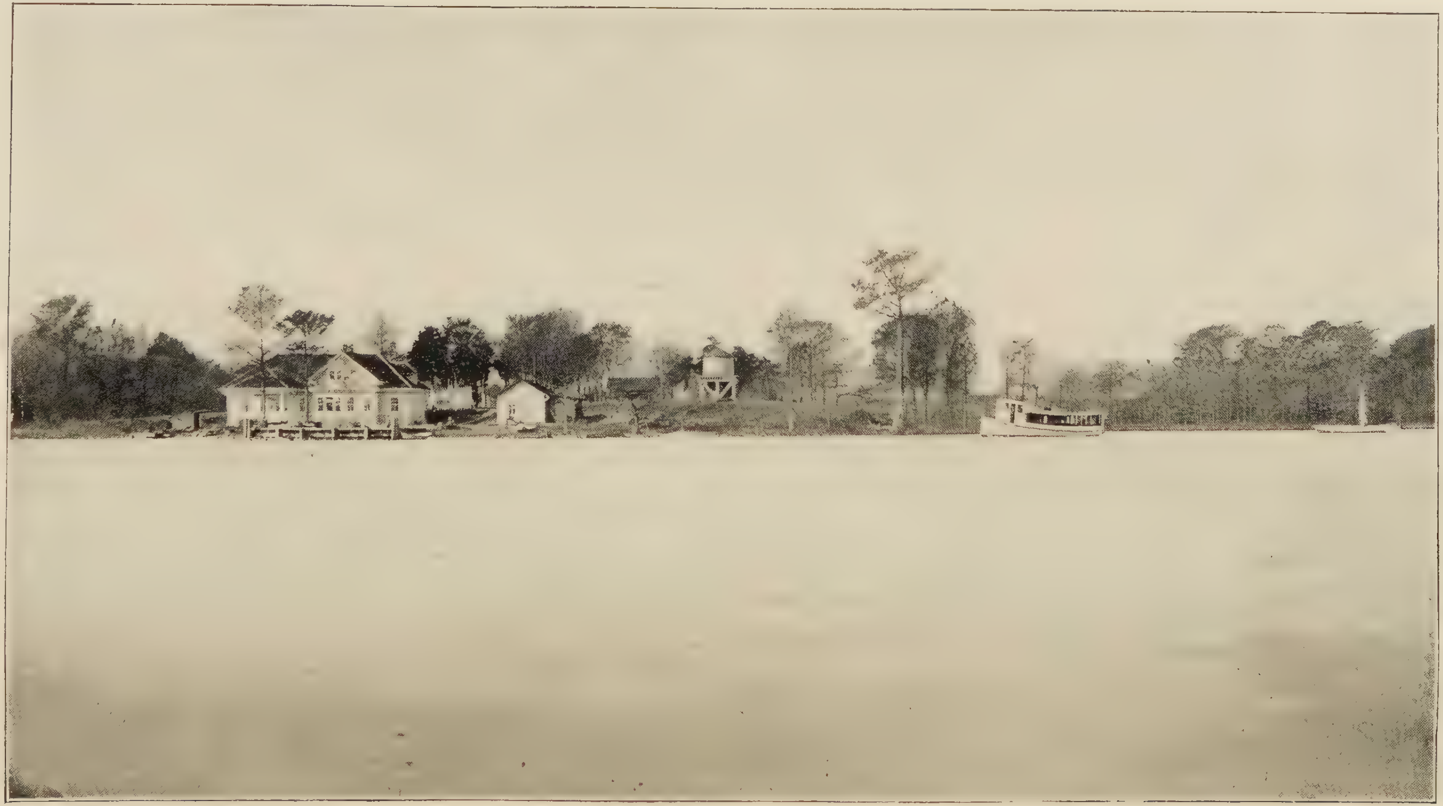
Edenton Station, North Carolina.—By act of Congress approved July 7, 1898, provision was made for establishing a fish-cultural station in the State of North Carolina. As this station was intended primarily for the propagation of shad, striped bass, black bass, and the perches, it was almost imperative that it should be located on the headwaters of Albemarle Sound, where the large shad and striped-bass fisheries are conducted, and where bass and perch are also abundant.

In December, 1898, this locality was examined by Mr. S. G. Worth, who was designated to select a site, his past experience having peculiarly fitted him to judge of the requirements needed for the contemplated station, as he had been in charge of the shad operations of the Commission on the Potomac River for many years, and had also been State fish commissioner of North Carolina. This investigation resulted in the selection of a tract of land comprising 15 acres, about a mile west of the village of Edenton, on the west bank of Pembroke Creek. An option was secured on the land on February 10, and as the act provided for the completion of the station by June 30, 1899, the Department of Justice was at once asked to secure the necessary titles.

On March 15 a communication was received from a committee appointed by the State Board of Agriculture of North Carolina, asking the Commissioner to meet the committee at Edenton on the 29th of March, or to send a representative, to discuss the eligibility of the site selected and to secure a better location if it could be found. A reply was made to the effect that an option had already been taken on the land, but the assistant in charge of the division of fish-culture was directed to meet the committee and explain fully the causes which led to the selection of the proposed site. At the meeting, which occurred on the date mentioned, certain objections were made to the location, principally that Pembroke Creek was so strongly infected with juniper that it was doubtful whether shad eggs would hatch in its water and that the location was too distant from the egg-producing area, viz, 7 to 15 miles. No evidence was produced to show that the creek was more strongly tainted than any of the other streams in the immediate vicinity except letters from individuals, and letters testifying equally to the contrary were read in rebuttal; besides which a number of reputable citizens testified to the capture of shad in the stream. Steps were at once taken to have this matter thoroughly tested, and under the direction of Capt. James A. Smith, of the steamer *Fish Hawk*, a temporary hatchery was erected on the creek where, during the month of April, 375,000 shad eggs were hatched with a loss of 18 per cent.

The results thus obtained by actual operations would seem to fully justify Mr. Worth's selection, and the purchase was consummated April 11, 1899. This location affords suitable water for the hatchery, and the lay of the land is favorable to the construction of the necessary buildings and ponds. The hatchery has been completed. It is a two-story frame building 70 by 30 feet, designed to accommodate 300 universal hatching-jars placed on eleven tables and on shelves along the sides of the room, this arrangement permitting the hatching of about 30,000,000 shad eggs at a time. The water is obtained from Pembroke Creek, whence it is pumped into a 6,000-gallon tank for distribution through the hatchery. A frame pump-house 30 by 15 feet, with a fuel-house attached, has been completed and a 15-horsepower horizontal Simplex Blake pump with a No. 5 boiler has been installed. It is proposed to furnish water for the bass ponds from artesian wells, several of which will be driven, and during the coming year the ponds will be constructed and other buildings erected. A T-shaped landing-pier 95 feet long has been built and the grounds surrounded with a wire fence.

Plans for the new stations have been prepared by the architect and engineer, Mr. H. von Bayer, who has had the general oversight of the construction work involved, besides the more important alterations at other stations. Plans of these stations and of those completed during the preceding fiscal year are shown after page C.



EDENTON STATION, NORTH CAROLINA—HATCHERY AND BOILER-HOUSE.

NEW TRANSPORTATION CAR.

The new stations which have been placed in operation during the last two or three years, and the consequent increase in the output of the Commission, have rendered necessary an increase of transportation facilities to distribute the greater quantity of fishes now available. Under the authority of an act of Congress approved March 3, 1899, a contract was made with the Jackson & Sharp Company, of Wilmington, Del., to build a fish-transportation car to replace the old one known as car No. 4. The new car is supplied with all the appliances and conveniences which experience has shown to be essential, and is similar in construction, dimensions, and arrangement to car No. 3, described on page XXXVI of the report for 1898. It is, however, somewhat higher than No. 3, being 14 feet over all. Bolted to the side sills and running the full length of the car is a plating of steel ½ inch thick, 8½ inches wide, and 60 feet long. The car is equipped with standard steel platforms and national combination couplers, and Pullman trucks with 38-inch wheels. The car formerly known as No. 4 is simply a baggage car arranged with sleeping quarters and circulating apparatus, and could only be used as an auxiliary, and, on account of its age, lack of facilities, and structural weakness, was not available for long trips.

EXPOSITIONS.

The Trans-Mississippi and International Exposition at Omaha, Nebr., in which this Commission participated, and which was in progress at the close of the fiscal year, terminated November 1, 1898. The exhibit of the Commission was described in the report for 1898, page XXXVII, and was similar in its scope and plan to those shown at the Atlanta and Nashville expositions, reports of which have already been published. The exhibit was in charge of Mr. W. de C. Ravenel, and was designed to illustrate the work of the different branches of the Commission. As at former expositions, the display attracted favorable attention and comment from visitors.

The Commission was awarded five bronze medals and five diplomas for an "interesting and instructive exhibit," for "fish-culture," for "statistics of fisheries," for "live-fish display," and for "scientific inquiry." A medal and diploma were also awarded to each of the following persons for valuable services rendered to the Exposition in connection with the exhibit of the Commission: George M. Bowers, W. de C. Ravenel, Hugh M. Smith, S. P. Bartlett, Frank N. Clark, E. A. Tulian, H. D. Dean, E. F. Locke, G. A. Schneider, R. J. Conway, W. P. Sauerhoff.

Under the authority of an act of Congress approved March 3, 1899, providing for the participation of the Government in the Pan-American Exposition, to be held in Erie or Niagara County, N. Y., in 1901, Mr. Ravenel was appointed, on April 28, 1899, the representative of this Commission on the Government board of managers.

LIBRARY AND PUBLICATIONS.

There were added to the library during the year 441 books and pamphlets bearing on fish-culture, the fisheries, and related subjects, besides various periodicals.

During the fiscal year the bound report for 1898, with appendices, and the bound Bulletin for 1897 were issued. These volumes comprise the following articles, which were also issued separately:

Proceedings and papers of the National Fishery Congress. Bulletin for 1897, pp. 145–371.
Proceedings of National Fishery Congress. Bulletin for 1897, pp. 147–168.
Methods of plankton investigation in their relation to practical problems, by Jacob Reighard. Bulletin for 1897, pp. 169–175.
The importance of extended scientific investigation, by H. C. Bumpus. Bulletin for 1897, pp. 177–180.
The utility of a biological station on the Florida coast in its relations to the commercial fisheries, by Seth E. Meek. Bulletin for 1897, pp. 181–183.
Establishment of a biological station on the Gulf coast, by W. Edgar Taylor. Bulletin for 1897, pp. 185–188.
Some notes on American shipworms, by C. P. Sigerfoos. Bulletin for 1897, pp. 189–191.
An economical consideration of fish parasites, by Edwin Linton. Bulletin for 1897, pp. 193–199.
The fish fauna of Florida, by B. W. Evermann. Bulletin for 1897, pp. 201–208.
The lampreys of central New York, by H. A. Surface. Bulletin for 1897, pp. 209–215, plates 10 and 11.
The protection of the lobster fishery, by Francis H. Herrick. Bulletin for 1897, pp. 217–224.
The Florida commercial sponges, by Hugh M. Smith. Bulletin for 1897, pp. 225–240, plates 12–31.
On the feasibility of raising sponges from the egg, by H. V. Wilson. Bulletin for 1897, pp. 241–245.
The Hudson River as a salmon stream, by A. Nelson Cheney. Bulletin for 1897, pp. 247–251.
A plea for the development and protection of Florida fish and fisheries, by James A. Henshall. Bulletin for 1897, pp. 253–255.
International protection for the denizens of the sea and waterways, by Bushrod W. James. Bulletin for 1897, pp. 257–263.
The restricted inland range of shad due to artificial obstructions, and its effect upon natural reproduction, by Charles H. Stevenson. Bulletin for 1897, pp. 265–271.
The green turtle and the possibilities of its protection and consequent increase on the Florida coast, by Ralph M. Munroe. Bulletin for 1897, pp. 273–274.
Some factors in the oyster problem, by H. F. Moore. Bulletin for 1897, pp. 275–284.
The oyster-grounds of the west Florida coast: their extent, condition, and peculiarities, by Franklin Swift. Bulletin for 1897, pp. 285–287.
The oysters and oyster beds of Florida, by J. G. Ruge. Bulletin for 1897, pp. 289–296.
The Louisiana oyster industry, by F. C. Zacharie. Bulletin for 1897, pp. 297–304.
The oyster bars of the west coast of Florida, their depletion and restoration, by H. A. Smeltz. Bulletin for 1897, pp. 305–308.
Notes on the fishing industry of eastern Florida, by John Y. Detwiler. Bulletin for 1897, pp. 309–312.
Oysters and oyster-culture in Texas, by I. P. Kibbe. Bulletin for 1897, pp. 313–314.
The methods, limitations, and results of white-fish culture in Lake Erie, by J. J. Stranahan. Bulletin for 1897, pp. 315–319.
A brief history of the gathering of fresh-water pearls in the United States, by George F. Kunz. Bulletin for 1897, pp. 321–330.
The red-snapper fisheries; their past, present, and future, by Andrew F. Warren. Bulletin for 1897, pp. 331–335.
Some brief reminiscences of the early days of fish-culture in the United States, by Livingston Stone. Bulletin for 1897, pp. 337–343.
The relations between State fish commissions and commercial fishermen, by W. E. Meehan. Bulletin for 1897, pp. 345–348.
Possibilities for an increased development of Florida's fishery resources, by John N. Cobb. Bulletin for 1897, pp. 349–351.
The utility and methods of mackerel propagation, by J. Percy Moore. Bulletin for 1897, pp. 353–361.
The large-mouth black bass in Utah, by John Sharp. Bulletin for 1897, pp. 363–368.
Florida fur-farming, by J. M. Willson, jr. Bulletin for 1897, pp. 369–371.

The fresh-water pearls and pearl fisheries of the United States, by George F. Kunz. Bulletin for 1897, pp. 373–426, plates I–XXII.
Report of the Commissioner for the fiscal year ending June 30, 1898, including the reports on divisions of fish-culture, scientific inquiry, and fisheries, by George M. Bowers. Report for 1898, pp. I–CLXXXI, plates I–XXI.
Report on mackerel investigations in 1897, by J. P. Moore. Report for 1898, pp. 1–22.
Report on fishes obtained by the steamer *Albatross* in the vicinity of Santa Catalina Island and Monterey Bay, by Charles H. Gilbert. Report for 1898, pp. 23–29, plates 1 and 2.
Notes on the extent and condition of the alewife fisheries of the United States in 1896, by Hugh M. Smith. Report for 1898, pp. 31–43.
Report on the oyster-beds of Louisiana, by H. F. Moore. Report for 1898, pp. 45–100, plate 3.
The shad fisheries of the Atlantic coast of the United States, by Charles H. Stevenson. Report for 1898, pp. 101–269.
List of fishes collected at the Revillagigedo Archipelago and neighboring islands, by David S. Jordan and R. C. McGregor. Report for 1898, pp. 273–284, plates 4–7.
Report on investigations by the U. S. Fish Commission in Mississippi, Louisiana, and Texas in 1897, by B. W. Evermann. Report for 1898, pp. 285–310, pls. 8–36.
List of publications of the U. S. Commission of Fish and Fisheries available for distribution on March 1, 1899. Report for 1898, pp. 311–327.
Report upon exhibit of the U. S. Fish Commission at the Tennessee Centennial Exposition in 1897, by W. de C. Ravenel. Report for 1898, pp. 329–339, pl. 37.

The continued public interest in the work of the Commission is shown by the requests received for its publications, 3,511 bound and 8,513 pamphlet copies of which have been distributed.

The Museum of Comparative Zoology published in August, 1898, a paper relative to the investigations conducted by the Fish Commission steamer *Albatross* in 1891, entitled:

Preliminary Report on *Branchiocerianthus urceolus*, a new type of Actinian, by E. S. Mark. Bull. Museum of Comparative Zoology, vol. XXXII, pp. 148–154, 3 plates.

The expenditure of the appropriations for the last fiscal year was reported to Congress December 6, 1898 (House Doc. No. 40, Fifty-fifth Congress, third session).

Appropriations for conducting the operations of the Commission for the fiscal year ending June 30, 1899, were made by Congress as follows:

Salaries	$197, 900
Miscellaneous expenses:	
Administration	9, 000
Propagation of food-fishes	140, 000
Maintenance of vessels	30, 500
Inquiry respecting food-fishes	10, 800
Statistical inquiry	5, 000
For new boilers and general repairs to the steamer *Albatross*	26, 000
For establishment of fish-cultural stations in—	
North Carolina	15, 000
Georgia	15, 000
State of Washington	10, 000
For completion of stations now under construction at—	
Erwin, Tenn	6, 018
Spearfish, S. Dak	5, 000
Manchester, Iowa	6, 000
Bozeman, Mont	1, 500
Nashua, N. H	7, 000
For repair and improvement of station at Duluth, Minn	1, 000
For construction of fish-distribution car	8, 000

A report showing in detail the expenditure of these amounts will be made to Congress in accordance with law.

GEORGE M. BOWERS,
Commissioner.

WYTHEVILLE STATION, VIRGINIA. HATCHERY AND RESIDENCE.

REPORT ON THE PROPAGATION AND DISTRIBUTION OF FOOD-FISHES.

By W. DE C. RAVENEL, *Assistant in Charge.*

INTRODUCTION.

The work of the division of fish-culture during the past year was the most extensive that has ever been accomplished, and was largely due to the increase in the appropriations made by Congress. The total number of fish and eggs distributed was 1,056,371,898, representing the important commercial fishes of the Great Lakes and the Atlantic and Pacific coasts, such as the cod, shad, white-fish, lake trout, pike perch, salmon, and lobsters.

The fish-cultural work of the various stations is given in detail in the abstracts from the reports of the superintendents, and embraces the propagation of 26 species of fish and 1 crustacean.

The following stations and auxiliary stations were operated during the year:

Green Lake Station, Maine.
Craig Brook Station, Maine.
St. Johnsbury Station, Vermont.
Gloucester Station, Massachusetts.
Woods Hole Station, Massachusetts.*
Cape Vincent Station, New York.
Steamer *Fish Hawk* (Albemarle Sound and Delaware River).
Battery Station, Maryland.
Bryan Point Station, Maryland.
Central Station, Washington, D. C.
Fish Lakes, Washington, D. C.
Wytheville Station, Virginia.
Erwin Station, Tennessee.
Put-in Bay Station, Ohio.
Northville Station, Michigan.
Alpena Station, Michigan.
Duluth Station, Minnesota.
Quincy Station, Illinois.
Manchester Station, Iowa.
Neosho Station, Missouri.
San Marcos Station, Texas.
Leadville Station, Colorado.
Bozeman Station, Montana.
Baird Station, California.
Battle Creek Station, California.
Clackamas Station, Oregon.
Upper Clackamas Station, Oregon.
Salmon River Station, Oregon.
Little White Salmon River Station, Washington.

As usual, special attention was paid to the propagation of the quinnat salmon on the Pacific coast, where five stations were operated—two in the Sacramento Valley in California and three in the Columbia River Basin in Oregon and Washington. Though the total number of eggs collected was not as great as in the previous year, over 29,000,000 fry were liberated in the Sacramento River and its tributaries, and 12,869,242 in streams of the Columbia River Basin.

In view of the excellent results attained by the introduction of steelhead trout in the Great Lakes and in streams in States bordering on the Atlantic, and as Fort Gaston Station had been abandoned, arrangements were made for collecting eggs of this species on the Willamette River, near Oregon City.

On the Great Lakes the collection of white-fish eggs was practically limited to Lake Erie, owing to restrictive laws passed by the States of Michigan and Wisconsin, prohibiting the capture of fish during the spawning season. Following the same lines of the previous year, arrangements were made not only for collecting eggs from commercial fishermen, but 12,785 adult fish were penned, which produced over 102,000,000, making a total collection of 185,454,000, an increase of 72,000,000 over the previous season.

The lake-trout work on Lakes Superior, Michigan, and Huron was conducted as usual, and resulted in the distribution of 9,500,000 fry in those waters. During the early spring the collection of pike-perch eggs was undertaken not only on Lake Erie, but also on Saginaw Bay, Michigan, and on the Missisquoi River, Vermont. On Lake Erie the season's work was very satisfactory, 493,000,000 eggs being obtained. All of these were hatched and planted in Lake Erie, except 24,000,000 transferred to Cape Vincent Station and 41,630,000 to Alpena. There is little doubt but that with the experience gained on the Missisquoi River and in Saginaw Bay very successful work can be accomplished in those fields in the future.

During the season numerous experiments were carefully undertaken to determine a method to prevent adhesion of fish eggs during artificial hatching, and it was decided that the use of swamp muck was advisable where large numbers of eggs were to be handled.

Marine fish-cultural work was confined to Woods Hole and Gloucester stations on the coast of Massachusetts, and embraced the collection and hatching of eggs of the cod, flat-fish, and lobster. The cod eggs were collected at Plymouth and Kittery by spawn-takers stationed on sailing vessels fishing from those ports and from brood-fish collected during the fall months by the schooner *Grampus*, and resulted in the liberation of 208,000,000 fry along the coast.

The flat-fish work at Woods Hole was interfered with materially by unseasonable weather during the latter part of February, but from the collections made in the vicinity of Woods Hole and East Greenwich, R. I., over 52,000,000 fry were hatched and planted in those vicinities.

In the early spring the lobster work was taken up on the New England coast and arrangements were made for collecting egg-bearing lobsters from Rockland, Me., to Rhode Island. The eggs from above Cape Cod were hatched at Gloucester and those below at Woods Hole. Through the active interest taken by the commissioner of sea and shore fisheries of the State of Maine and by employing an additional steam vessel and spawn-takers our collections in this section were materially increased, and notwithstanding the fact that the catch of lobsters was no greater than the previous year 77,390,000 eggs were handled at Gloucester and 44,458,000 at Woods Hole, which yielded 110,491,000 fry. These were planted at suitable points along the coast from Rockland to Long Island Sound. Although this fishery is apparently steadily declining, judging by the numbers of lobsters taken by the fishermen

PLATE VIII.

BOZEMAN STATION, MONTANA—FROM THE MOUNTAIN, LOOKING WEST.

each year, it is believed that the large number of fry planted in the last few years will have an appreciable effect, as correspondents from various points report the presence of large numbers of young lobsters.

Shad work commenced on Albemarle Sound in March, where the steamer *Fish Hawk* had been ordered for duty. At the close of the season there she proceeded to the Delaware, and continued in this work until the end of June, collecting over 72,000,000 eggs. These, with the large number taken at Bryan Point on the Potomac River and at Havre de Grace on the Susquehanna, produced over 235,000,000 fry, which were liberated in the numerous shad streams emptying into the Atlantic Ocean.

The output of trout, salmon, bass, and crappie from the inland stations was very satisfactory. These fish are now abundant in many parts of the country to which they are not indigenous. At Leadville, Colo., where a station was originally established for the propagation of the black-spotted trout, during the past season over 3,000,000 eggs of the brook trout were collected from lakes controlled by private parties.

The grayling work in Montana was very satisfactory, and the indications are that large numbers of these eggs can be collected annually, which will permit the introduction of this valuable fish in most of the States where brook trout are now found.

RESULTS OF FISH-CULTURE.

Although no systematic effort is made to investigate the various streams and lakes stocked with new varieties of fish, the office is in receipt constantly of communications showing the result of their introduction. Particularly gratifying reports have been received from Minnesota with reference to the introduction of steelhead trout in Lake Superior. Mr. L. E. Baldridge, foreman of Duluth station, Minnesota, reports, under date of March 13, 1899, that large numbers of steelhead trout, varying in length from 7 to 28 inches, were caught during the summer and fall of 1898 along the north shore of Lake Superior, between Duluth, Minn., and Rossport, Ont. Mr. D. J. Greensword, treasurer of the Duluth Fly-Casting Club, informed him that a number of members of his club took over 400 steelhead trout from Sucker River in two days' fishing with hook and line and that he had captured 85 in a single day. He further states that not less than 2,200 steelheads were taken in the same manner from the French and Sucker rivers and that they take the fly as readily as do the brook trout. The fishermen operating gill nets along the north shore for lake trout have also captured a number, varying from 14 to 18 inches in length. It appears that the steelheads caught in nets had slipped through the nets until the twine was just forward of the dorsal fin, which would indicate that they were too small to be taken in very large numbers in the large-mesh nets used for the capture of lake trout. The steelheads are probably as plentiful in other rivers along the north shore, which are not visited on account of their remoteness from Duluth.

Mr. E. H. Ashcroft, of Coudersport, Pa., reports the capture of a rainbow trout, measuring 17 inches and weighing 33 ounces, from the headwaters of the Allegheny, which is supposed to have resulted from a plant made in that stream six years ago. He states that a few have been caught each year, both large and small, showing that the fish are reproducing.

On November 6 Mr. Hiram Cady delivered to the superintendent of the Michigan stations, Mr. Frank N. Clark, a lake trout said to have been caught in Walnut Lake, Oakland County, Mich. As this is a small inland lake, and as it was not known to contain lake trout, a net was set on the 17th of November and 5 large male and female trout, 4 white-fish varying from 2 to 4 pounds, 1 pike perch, and a number of unimportant species were captured. On November 18 12 white-fish were taken, 8 of them within a space of 6 feet, showing not only that the fish travel in schools, but that they are abundant in the lake. The trout are supposed to be the result of a plant of 20,000 fingerlings in Walnut Lake from Northville, in 1890.

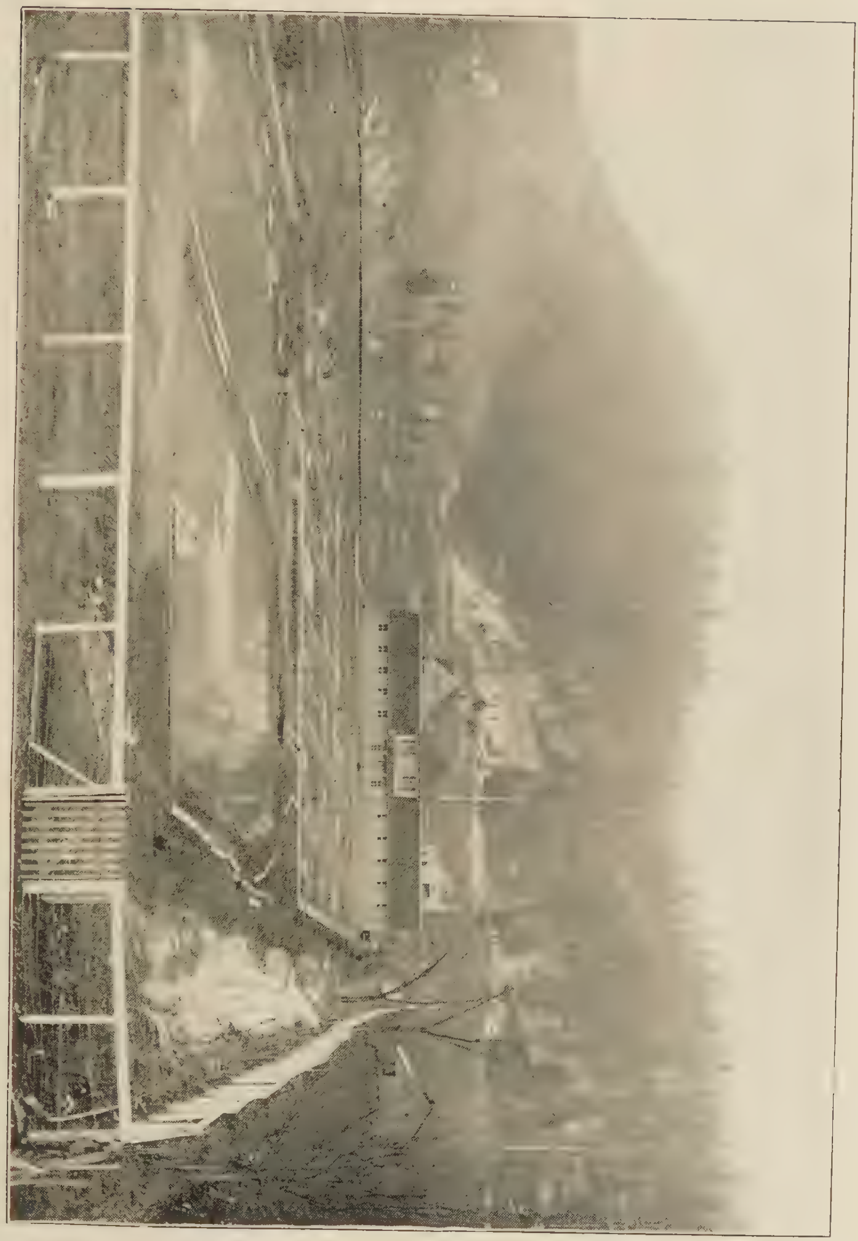
Dr. James A. Henshall, superintendent of Bozeman station, Montana, reports that during the past year a number of steelhead and eastern brook trout have been taken in Bridger Creek, which runs through the Bozeman station grounds, and which is a natural trout stream about 20 miles long, with an average width of 30 feet. The only fishes native to its waters are the black-spotted trout and Rocky Mountain white-fish. Steelheads have also been captured with the fly in Bozeman Creek, which was accidentally stocked in the fall of 1897 by a can of fry jolting from the wagon into the stream from a load of fish intended for Mystic Lake.

From various correspondents it would appear that the efforts to stock the waters of Vermont with landlocked salmon are producing good results. Mr. F. A. Woodbridge, of Newport, Vt., reported the capture of 10 landlocked salmon in the Clyde River, at Derby, of about 7 inches in length. Mr. E. S. Whitcomb, of Underhill, Vt., also reports the capture of a steelhead trout in Browns River, Essex, weighing 2½ pounds and 19 inches long, and of another weighing 3⅝ pounds; also a number of smaller ones. They have been frequently reported from Lake Champlain and its tributaries.

SPECIAL INVESTIGATIONS AND INSPECTION.

During July, acting under the direction of the Commissioner, Mr. Ravenel visited the Pacific coast to arrange for the transfer of Battle Creek station from the California Fish Commission and the purchase of the necessary land from Mr. F. R. Love, who owned the site on which the California station was located. The transfer of the State property in Battle Creek was satisfactorily arranged in San Francisco with the State commissioners, but after a careful examination, with Mr. John P. Babcock, of the California Commission, and Mr. G. H. Lambson, superintendent of Baird station, it was decided that to insure the operation of the station to its full capacity it would be necessary not only to

PLATE IX.



ERWIN STATION, TENNESSEE.—POND SYSTEM AND HATCHERY.

for completing a certain portion of the ponds, as it was found that the appropriation would not be sufficient to finish the station as originally planned. A large amount of work had been accomplished in clearing and grading the grounds, and in putting in water-supply pipes, etc. The property was fenced and considerable work had been done in excavating several large ponds. In addition to this, the springs had been cleaned out and cement basins constructed, the channels straightened, and a number of other minor improvements made.

Through the courtesy of the Bulloch Brothers several temporary ponds were constructed in their mill pond, which had been stocked with bream and bass. A number of schools of small bass were visible at this time, and although large results are not expected, the experience gained will be of much value to the force during the next year's work. From the progress made there is no reason why a sufficient number of ponds should not be completed to permit of the operation of this station during the next fiscal year. The superintendent was instructed to utilize the funds available for the completion of the main part of the station and construction of residence, leaving for after consideration the section lying to the south of Cold Spring Brook, which embraces the south spring reservoir and Ponds M and L.

STURGEON.

The rapid decline of the sturgeon fishery, as evidenced not only by the decreasing catch along the Atlantic coast, but also in the Great Lakes and on the Pacific coast, and the immense increase in the price for caviar, accentuated the necessity for making another attempt to undertake the propagation of this valuable species.

In May Mr. Ravenel made a preliminary investigation of the fishery on the Delaware River, which is distributed over about 75 miles of that river, with Delaware City as its center. Conferences with prominent dealers assured us of their hearty cooperation; and on May 23 Mr. L. G. Harron, who had been in charge of the shad-hatching operations on the Potomac River, was instructed to proceed to Delaware City to undertake this work. Accompanied by a force of spawn-takers, and with a steam launch for visiting the fisheries in the vicinity, operations were commenced May 27, arrangements having been made with Mr. Sadler for erecting a temporary hatchery on his wharf and for the use of his boiler and pumps to obtain a water supply. Various forms of apparatus were provided, including floating boxes, to be anchored in tide water, McDonald hatching-jars, and troughs equipped with wire trays. All of the principal fishing-grounds and floats where sturgeon were butchered were visited daily from May 29 to June 13; but although a number of ripe sturgeon were reported as having been captured, investigation would indicate that the fishermen were mistaken, though it is believed that at least two overripe fish were taken at Bayside. Fishing ceased on June 15, so that it was necessary to discontinue the work.

Although a large number of sturgeon are caught in this vicinity during the season by the 500 boats fishing from Delaware City to

Bayside, within a radius of 20 miles, the problem of securing ripe fish alive is more difficult than would appear at first glance. Over 50 per cent of the female fish caught are dead when brought to the butchering float, usually because they are hooked in vital spots when pulled into the boat, causing them to bleed to death within a short time. Of over 200 sturgeon which were butchered while Mr. Harron was at Delaware City, three-fourths were with hard roe, two were overripe, four had spawned, and two were apparently nearly ripe. Although this year's work was unsuccessful, it is believed that, with the cooperation of the fishermen, who are deeply interested in this question, and by taking up the work on the 1st of May, better results can be secured another season.

An auxiliary station was established on the Missisquoi River, Vermont, and on Lake Champlain, with the view to propagating the lake sturgeon; but the efforts resulted in failure, though much valuable experience was gained, which, it is believed, will result in obtaining a fair number of eggs next season. A full report of this work is published under the abstract from Cape Vincent station.

EXPOSITION AT OMAHA.

The Trans-Mississippi and International Exposition, which was in progress at the close of the fiscal year, terminated October 31. At the approach of warm weather, during the latter part of June, the fishes in the aquarium supplied with ordinary river water began to show signs of disease. It was found that the water, although filtered before being used, was charged with injurious parasites and the spores of fungus; and at one time it was thought that it would be necessary to abandon certain parts of the exhibit, as the loss was very heavy. Several remedies were tried, including a weak solution of alcohol, but the most effective was ordinary Turks Island salt, 1½ sacks per day being required when the disease was at its height. By a liberal use of salt and by restocking the aquarium, the exhibit of native fishes was kept in an excellent condition to the close of the season. That part of the fresh-water exhibit comprising the trouts and salmons was a very attractive feature throughout the exposition. By means of an ice machine cold water was abundantly supplied during the heated term. The maximum temperature in the trout and salmon tanks during the month of June was 60°, with a minimum of 51° and a mean temperature of between 54° and 55°; whereas in the other tanks, which were supplied with ordinary river water, the temperature reached 91°. These fish were shipped from the Fish Commission stations in Colorado, Michigan, Iowa, and Missouri.

The salt-water exhibit, which had opened with a fine display of the important economic food-fishes of the New England coast, did not prove as satisfactory as was anticipated, many of the best specimens dying at the approach of warm weather. In making an exhibit of this character, it will be hereafter necessary to provide for keeping the temperature of the water below the danger mark in localities like Omaha. This exhibit was finally abandoned in August, and fresh-water fishes substituted.

The fish-cultural work, which was practically illustrated by the hatching of grayling during the month of July, and quinnat-salmon eggs (shipped from the Pacific coast) during September and October, proved very instructive and entertaining. During the entire exposition there were exhibited in the aquarium various kinds of fry which had been hatched on the grounds, including a large number of quinnat-salmon fry.

At the close of the exposition all the fish on hand which were not liberated in the vicinity of Omaha were turned over to the Nebraska Fish Commission for distribution to the public waters of the State. The aquarium was dismantled and, with the other exhibits, shipped to Washington, under the direction of Mr. R. J. Conway, assisted by Mr. W. P. Sauerhoff, to whose untiring energy and attention much of the success attained was due; Mr. Conway being in charge of the aquarium and general management of the exhibit during the exposition, and Mr. Sauerhoff of the fish-cultural work.

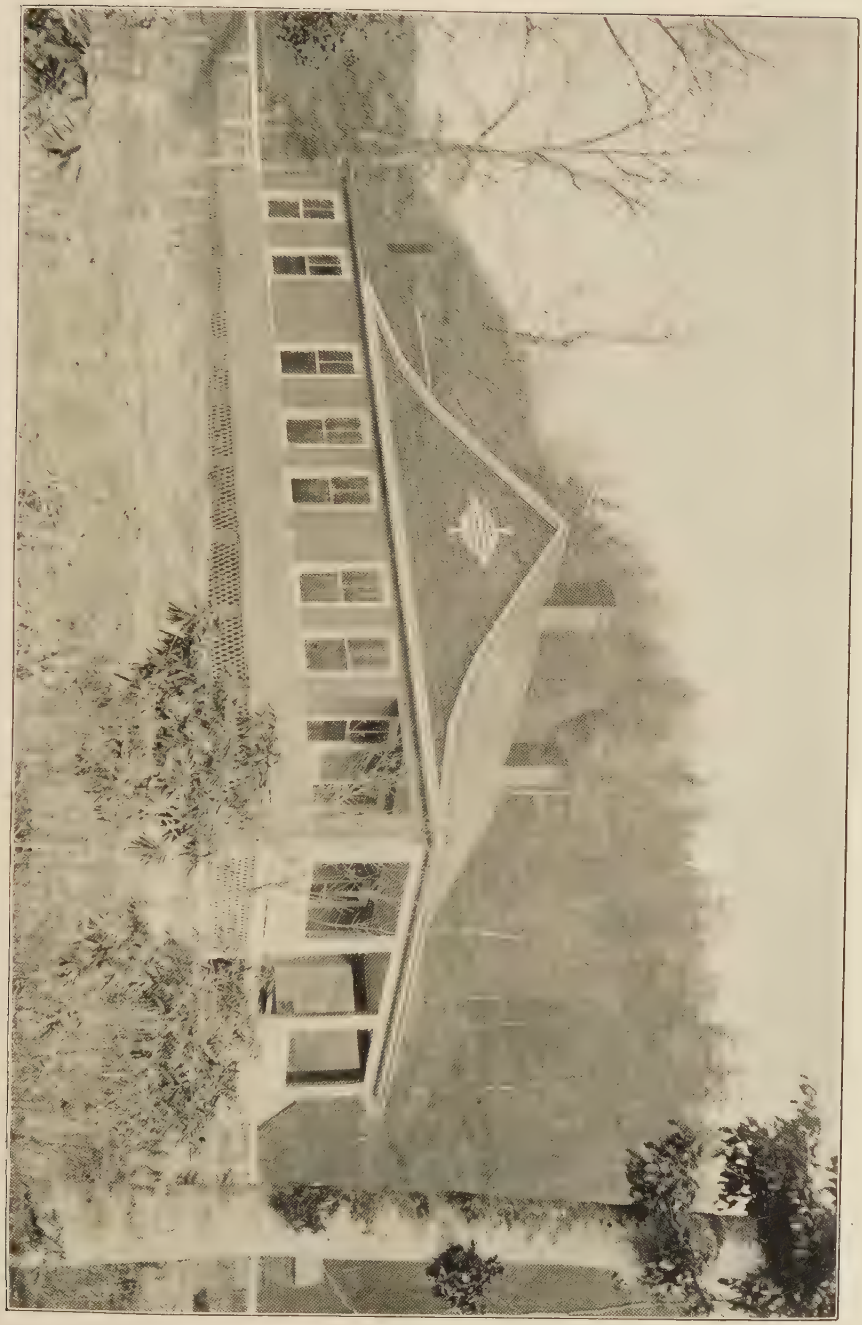
CAR AND MESSENGER SERVICE.

The demands in this branch of the service, which remains under the charge of Mr. J. F. Ellis, have greatly increased during the past few years, owing to the increase in the number of stations and the greater number of requests for fish from all parts of the country. During the year the four cars were actually engaged in distribution 845 days and traveled 95,374 miles, distributing 100,578,000 fish, with a total loss of 1,288,000, or 1.28 per cent. The remaining fish furnished for distribution, amounting to 955,793,000, were planted by detached messengers and employees of the various stations, who traveled 138,847 miles in making said distribution. Of these, 4,938,854 were lost en route, or 0.5 per cent. The percentage of fish lost by messengers is necessarily much smaller than where handled on the car, as in many instances the plants are made within a mile or less of the station, whereas on the cars they are frequently held for eight and ten days and carried many thousand miles in varying latitudes and temperatures.

The work in this branch of the service has been exceedingly satisfactory, though no important changes or improvements were made, except increasing the capacity of the air-pumps on several of the cars and the substitution of steel platforms and new couplers for the old forms. All of the cars were overhauled and repaired during the season at a cost of $3,550. In addition to the routine work of the division, the cars were called on to transport the fish exhibited at Omaha, involving two trips with salt-water fishes from Woods Hole to Omaha, besides a number of trips from the stations at Quincy, Neosho, Manchester, and Northville. They were also used for collecting wild trout in Wisconsin for the Manchester station, and at the request of the Flint and Pere Marquette Railroad distributed a carload of pike perch in Michigan.

The superintendent renews his recommendation that two additional cars, with crews, be provided, as at present it is frequently necessary to borrow or hire cars from the various railroad companies, and to employ untrained temporary assistants to assist in the distribution.

PLATE X.



ERWIN STATION, TENNESSEE—FOREMAN'S COTTAGE.

STATION REPORTS.

GREEN LAKE, MAINE (E. E. RACE, SUPERINTENDENT).

During the spring and summer a number of improvements were made, increasing materially the effectiveness of the station. The most important change was the thorough overhauling of the main supply-flume through which the water from Rocky Pond is conducted. Its foundation had settled in places, and this (together with damage by ice the previous winter) caused leaks at many points and allowed the escape of about 1,200 gallons of water per minute. The hatchery, stable, and outbuildings were repainted and 20 new troughs, each 15 feet long, were built and installed in the nursery. The old spawning-house at Great Brook and the two old buildings upon the land of Bridgham Haynes, near Green Lake, were moved to the station and fitted up for occupancy by the employees. A mill for grinding fish-food was also devised, which resulted in the saving of much time and labor. A heavy plank dam was put in the drain to carry off waste water from the ponds and hatchery, and in the rear of the dam a common overshot wheel was connected by a large pulley to a small pulley attached to the liver machine. This enables one man to prepare the food required for all the fish at the station in two hours, whereas the same amount of work used to require the services of two men each day.

The stock of fish on hand at the beginning of the year was as follows:

Species.	Calendar year in which fish were hatched.		
	1898.	1897.	1896.
Landlocked salmon	336,936		279
Steelhead trout	8,830	3,370	
Brook trout	13,831		

The landlocked salmon were held in the ponds and troughs during the summer with slight loss, only 3,381 having died between July 1 and December 19, when the distribution was completed. Those reared in ponds were much larger than those held in troughs, varying in length from 4½ to 6¾ inches, and averaging fifteen and eighteen to the pound. Of the brook and steelhead trout on hand at the beginning of the year, 8,880 brook trout were distributed in July and 2,767 steelheads of 1897 and 1,000 steelheads of 1898, during August, September, and October. The remaining steelheads—500 of the hatch of 1897—were held in the north reservoir, which contains a large amount of natural food, and are apparently doing well, having attained a length of from 7 to 11 inches. The loss on those of 1898 during the summer amounted to 2,704, leaving only 5,000; these are being reared in one of the ponds for brood-fish. The landlocked salmon of 1896 have attained a length of 12 inches and will average from 1½ to 2 pounds in weight. The indications are that better results will be secured in their domestication than from any previously experimented with.

The white (albino) salmon are objects of much interest to the many visitors from Bar Harbor, Bangor, Ellsworth, and other points. They are in excellent condition and have reached a length of from 5 to 6 inches. It is not unusual to find three or four white salmon during the season among several hundred thousand normally colored fish, but they are more numerous this year than ever before. As they increase in size their color gradually changes from white to straw.

Early in the summer arrangements were made for collecting eggs of the landlocked salmon, brook trout, golden trout, and lake trout, at Winkempaugh Brook, Mann Brook, Patton Pond, Great Brook, Flood Pond, and Coldstream Pond. The traps and pens were repaired and operations commenced early in September with the following results:

Point of collection.	Species.	Fish.	Eggs.
Winkempaugh Brook	Brook trout	120	98,000
Do	Landlocked salmon	39	128,000
Patton Pond	Brook trout	126	99,000
Do	Landlocked salmon	8	11,000
Flood Pond	Brook trout	27	25,000
Do	Golden trout	35	4,000
Green Lake	Brook trout	7	2,000
Do	Landlocked salmon	84	228,000
Coldstream Pond	Lake trout	1,830	1,000,000
Do	Landlocked salmon	32	85,000

In addition to the eggs collected from the points mentioned above, 100,000 brook-trout eggs were purchased in March from dealers in Massachusetts, and 10,000 black-spotted trout eggs were presented by Mr. J. Annin, jr., of Caledonia, N. Y. The eggs collected at the field stations were all transferred to the hatchery as soon as practicable after being fertilized, except those at Enfield, which were held in the State hatchery until the eye-spots developed. The losses were very light except in the case of the brook trout, which commenced hatching in March and finished early in May. It being impracticable to rear brook trout at this station on account of the high temperature of the water during the summer, all of the fry on hand were distributed in May and June, 196,000 being planted. The heaviest mortality was among eggs collected at Winkempaugh Brook, due to the loss of nearly all the male fish as the result of a severe freshet.

Of landlocked salmon eggs 82,500 were shipped during winter; the balance were held at the station and hatched with comparatively small losses. At the end of the season 311,125 strong, healthy fry remained on hand, which will be distributed as usual during the fall months.

Owing to high water in Flood Pond but few golden-trout eggs were collected, and the resulting fry were liberated in Holbrook Pond and Green Lake during the spring.

The experience of the past few years has again demonstrated the fact that the method of measuring eggs to determine their number is not accurate, owing to great variation in the size of those obtained from the different waters. It is also believed that where the eggs have been measured or weighed, after having been in the troughs 100 days or more, a loss ensues. To obviate this loss eggs are now counted while the trays are in the hatching-troughs, and are never removed until about ready to hatch, when they are transferred to clean trays and placed in troughs with false bottoms. Each trough is allowed 15 gallons of water per minute, and the percentage of fry lost after hatching is much smaller than ever before. The use of salt in the troughs during the early stages has also been abandoned to a great extent, only 14 bushels being used during the past year. As a substitute for salt 6 quarts of fine clay are placed in each trough three times a week. After cleaning the ponds about 2 bushels of clay are thrown in. Clay is also used with great success before the fish hatch.

At the end of the year the stock on hand was as follows:

Species.	Calendar year in which fish were hatched.			
	1899.	1898.	1897.	1896.
Landlocked salmon	311,123	397		277
Steelhead trout		5,126	500	
Brook trout		829		

CRAIG BROOK STATION, MAINE (C. G. ATKINS, SUPERINTENDENT).

The work during the past year has been devoted principally to collecting and rearing Atlantic salmon at the main station and landlocked salmon at the substation on Grand Lake Stream. The Atlantic salmon work was conducted conjointly with the State of Maine, and consisted in the purchase of adult salmon in May and June, which were held in confinement in the fresh-water inclosure at Dead Brook until they spawned in October, when they were liberated.

At the beginning of the year the stock on hand was as follows:

Species.	Calendar year in which fish were hatched.					Wild fish.
	1898.	1897.	1896.	1895.	1894.	
Atlantic salmon	636,264				233	400
Atlantic salmon, domesticated		454			35	
Landlocked salmon	54,476				1	
Quinnat salmon		28				
Steelhead trout	38,745		188			
Rainbow trout	28,351					
Scotch sea trout	1,198			508	10	
Brook trout	2.666					
Total	761,700	482	188	508	279	400

In addition to the fish at Craig Brook there were 118,000 landlocked salmon at Grand Lake Stream, which were being held for distribution in the fall. These were reared in out-of door troughs, and were fed on chopped flesh of various kinds—beef liver, hogs' plucks, flesh of condemned horses, etc. The distribution was made during the summer and fall, the first plants being made in August and the last in January.

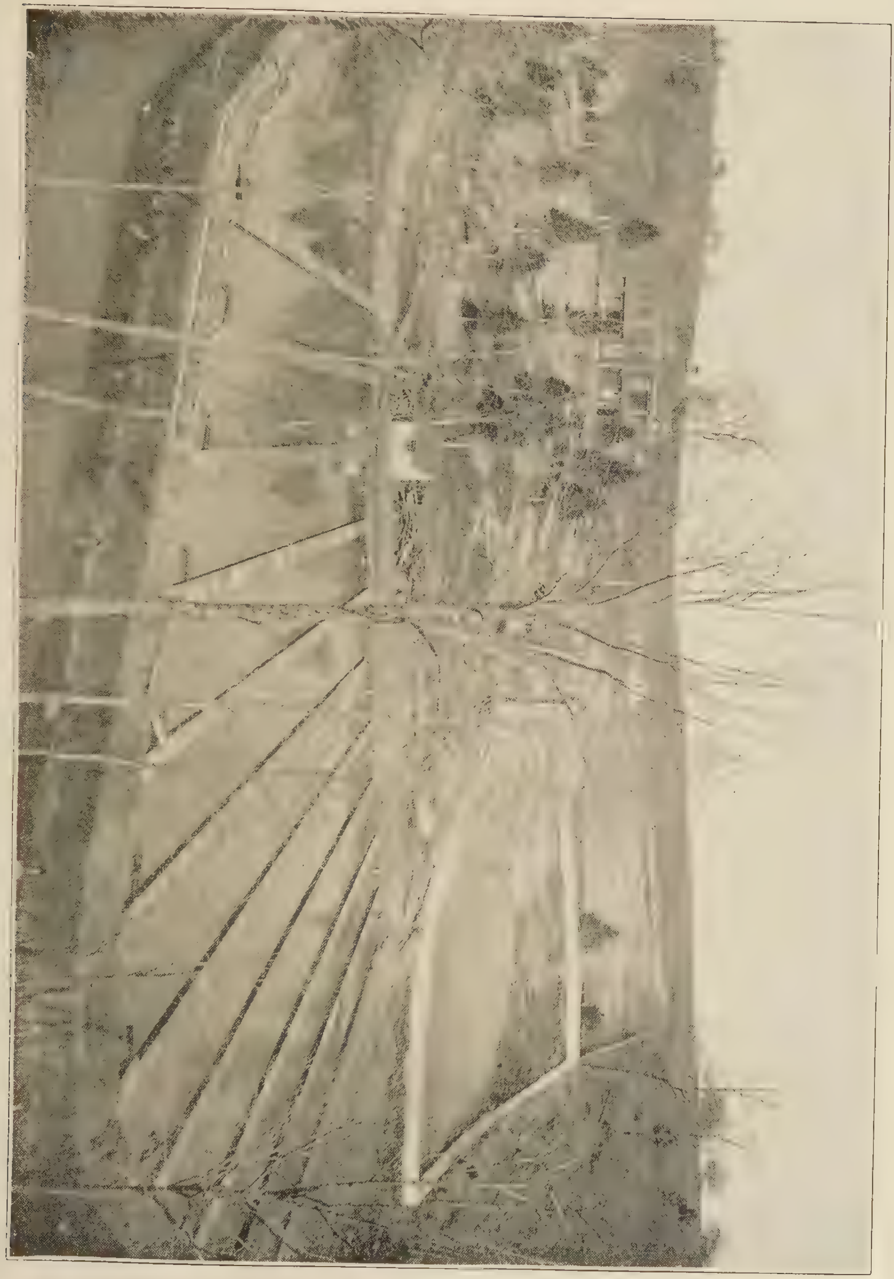
At the beginning of the year there were three broods of Atlantic salmon on hand. The first consisted of 400 adults, collected in May and June, 1898, and held at Dead Brook. The second lot of 233 were hatched in 1894, from eggs collected from migratory fish which had been held in a pond specially prepared for them for the purpose of experimenting in domestication. The third brood were the fry hatched in the spring of 1898, numbering 636,264. The losses on these were quite heavy late in the summer, and the number distributed amounted to only 391,898, or 61½ per cent of the stock on hand on June 30. These results were not satisfactory, compared with the output of the previous year, when over 85 per cent of the number on hand at the beginning of the year were successfully distributed in the fall months, having been reared under nearly the same conditions. The 4-year-old salmon were held until fall with a loss of only 4 per cent, and in November yielded 16,800 eggs of poor quality, which died by the end of April. On the recommendation of the superintendent the fish were liberated in Alamoosook Lake, and experiments in domestication were discontinued.

The salmon in the lot numbering 400 at the beginning of the year were reduced to 365 by November, when the spawning commenced. They yielded 2,147,677 eggs, which were reduced by losses to 1,862,767 when the division was made, the United States Fish Commission receiving 1,500,288, and the State of Maine 362,479. Of those belonging to this Commission, 656,000 were shipped to other State fish commissions and to private individuals; from the remainder, 842,017 fry were produced. In May the State of Maine turned over to the Commission the fry resulting from its share of the eggs, amounting to 354,080, making the number available for distribution 1,196,097. Of these, 450,000 were liberated in the waters of the main Penobscot River, between Passadumkeag and Mattawamkeag and the balance—704,496—was retained for disposition in the fall.

The term domesticated salmon, as used in this report, applies to salmon of the species *Salmo salar*, descended from parents hatched and reared at the station, having never gone to sea. On the 1st of July there were three lots—one of 2 fish hatched in 1892, one of 33 fish hatched in 1893, and one of 454 hatched in 1897. In November they yielded 15,800 eggs, but all of the fry hatched from them perished before the absorption of the sac. In view of the poor results obtained from the experiments it has been decided to abandon further attempts in this line and to liberate the fish in suitable waters.

Of the 54,476 landlocked salmon fry on hand in July, 45,379 were distributed during the fall and 3,961 retained. Of the 119,522 at Grand Lake Stream on June 1, 1899, 114,171 were distributed in Grand Lake Stream and Grand Lake in the fall. The trap for the collection of the adult landlocked salmon was finished in October and fishing began on October 28, continuing until November 21. During this period 866 salmon, 358 males and 508 females were collected. The largest male measured 24 inches and the shortest 13 inches, the average being 18.7; the largest female measured 22½ inches and the shortest 14 inches, the average being 18.8. The maximum weight of females was 4⅝ pounds, and the minimum 1 pound, the average being 2.59. Of the females captured 477 yielded 621,500 eggs, an average of 1,300 per fish. Of

PLATE XI.



WYTHEVILLE STATION, VIRGINIA—NEW REARING-PONDS.

these eggs 274,000 were shipped to Craig Brook and the remainder were held for hatching at Grand Lake Stream. These produced 272,672 fry, of which 130,797 were held until the close of the season, the balance being liberated in Grand Lake and Grand Lake Stream.

Of the eggs transferred to Craig Brook 160,000 were shipped to other points and the remainder were hatched. The fry resulting from them numbered 89,873 at the close of the year. Of the 28 quinnat salmon hatched in 1897, only 10 were found in September, the missing ones having probably been destroyed by minks; 188 were received in May from St. Johnsbury and placed in a large deep pond for the purpose of experimenting in the domestication of this fish.

From the lot of 2-year-old steelheads resulting from eggs shipped in 1896 from Fort Gaston, Cal., 4,500 eggs were secured during April; these were of inferior quality and only 1,637 of the fry produced from them survived to the end of the year. Of the 38,745 fry hatched in 1898 from eggs received from California there were distributed during the year 26,282. This lot of fish suffered from an obscure disease, the leading symptom of which was an apparently cancerous destruction of the fins, especially the caudal. A small lot were cared for in troughs to afford data with reference to this disease; 287 of these remain on hand.

The rainbow-trout fry resulting from eggs collected in Craig Brook from wild fish released in Alamoosook Lake in August, 1897, though suffering to a certain extent from the same disease which attacked the steelheads, were successfully carried through the summer and 23,565, or 72 per cent of those on hand at the beginning of the year, were distributed during the fall. In March and April 11,450 eggs were collected from fish in Alamoosook Lake. These yielded 7,290 fry, of which 4,829 remained on June 30.

A small number of Scotch sea trout hatched from the original invoice of eggs donated to the Commission by the journal *Shooting and Fishing* in 1891 still survive. They have occupied a small, deep, turbid pond since 1893 and have yielded eggs each year. Of their descendants several hundred active, healthy fish remain. From the other fish on hand 186,300 eggs of poor quality were collected. Only 56,551 of the fry resulting from them are on hand at the close of the year.

The fish food during the year consisted principally of liver, hog's plucks, horseflesh, aggregating 45,746½ pounds and costing $513.22. In view of the fact that for eight months the stock at the station varied from 750,000 to 2,000,000 fry, yearlings and adults, this is not excessive.

Two diseases, serious enough to demand notice during the year, differed in some respects from anything observed here before. The first heavy mortality occurred in July, August, and September among the Atlantic salmon in the ponds and troughs, compelling a great deal of extra work and entailing heavy losses. The other attacked the steelheads and rainbows, but did not, so far as observed, extend to many lots of these fish. It seemed to appear about the first of December, when part of the distribution had been made. Some of the affected lots were retained, and from the observations made the disease appeared to be of a cancerous nature, the fins, especially the dorsal, being the first point attacked. A somewhat similar ailment of the fins has often occurred in the past, but nothing ever approaching the severity of the disease this year. In many instances its course continued until the flesh of the trunk of the fish was entirely destroyed, laying bare the bony structure attached to several of the vertebræ entirely anterior to the caudal fin. It may be mentioned here that during the summer of 1898 a microscopic examination of the fish in the ponds and neighboring waters revealed almost everywhere, even among the wild native fishes of Craig Pond, the presence of a trematode parasite, which could not be distinguished from the species that attacked the lake trout with such fatal effect.

ST. JOHNSBURY STATION, VERMONT (JOHN W. TITCOMB, SUPERINTENDENT).

At the beginning of the year the stock of fish on hand was as follows:

Species.	Calendar year in which fish were hatched.			
	1898.	1897.	1896.	1895.
Steelhead trout	3,963			35
Rainbow trout			410	
Quinnat salmon		775		
Brook trout	6,199			
Landlocked salmon	9,138			

The 35 steelhead and 410 rainbow trout resulting from eggs hatched at the station in 1895 and 1896 were carried through the summer with comparatively small losses. In the fall a considerable number of eggs were collected from the steelheads, but many of them were glassy, as is common with eggs taken from 2-year-old rainbow trout. It would appear that the steelhead can be easily domesticated; the fry on hand at the close of the year were strong and healthy. The rainbow trout produced few eggs, and most of them were glassy when extruded.

During September the steelhead trout hatched in 1898 were planted in Crystal and Morey lakes and the landlocked salmon in Willoughby, Caspian, and Dunmore lakes. The brook-trout yearlings were distributed during the fall and early winter.

As the ponds at St. Johnsbury are very small and not adapted for rearing quinnat salmon, 200 were transferred to Craig Brook station in May and the remaining 147 were planted in Morey Lake.

Early in the summer field stations for collecting wild brook trout eggs were established at Darlings Pond, Groton; Lake Mitchell, Sharon, and Caspian Lake, Greensboro. Explorations were also made with the view to establishing additional stations at Little Leach Pond in Averill, Lake Dunmore at Salisbury, and ponds of the Wells River Fish and Game Club at Wells River.

On July 8 the construction of a trap was commenced at Darlings Pond, but no efforts were made to retain any fish during the warm weather. On September 20 A. H. Dinsmore was placed in charge and the first eggs were taken on September 28. Collections continued until October 25, during which period 680,000 were obtained from 6,092 fish captured, of which 510,000 eggs, or 75 per cent, were eyed. Late in the season many spent fish ascended the stream, showing that a considerable number spawn in the pond. On account of its dark color the water of the pond can not be examined more than a foot below the surface, and consequently the nests could not be located.

In support of the theory advanced in 1898 that the quality of the egg is affected by long confinement of the fish before ripening the following table is interesting and tends to confirm the statements then made:

When taken.	Number taken.	Number eyed.	Per cent eyed.	When taken.	Number taken.	Number eyed.	Per cent eyed.
1898.				1898.			
Sept. 28 and 29	76,089	63,000	82.8	Oct. 13	74,400	56,000	75.3
Oct. 1	85,450	74,000	86.6	15	47,000	34,000	72.4
3	108,510	86,000	79.3	17	46,300	34,000	73.5
5	94,300	76,000	80.6	19–25	60,000	23,000	38.4
7	45,150	33,000	73.1				
10	43,700	31,000	71	Total	680,899	510,000	74.9

Operations at Lake Mitchell, Sharon, were inaugurated July 23 by the construction of a trap. In September Mr. G. H. Tolbert was placed in charge of the station and at once commenced the construction of a shanty 8 by 12 feet, which was supplied with water by a spring in the immediate vicinity. The volume of water from this spring amounts to only 10 or 12 gallons per minute. On October 8, when Mr. Tolbert was transferred to Danby, about 700 trout had been captured, and subsequent takes brought the total to 2,100. The first eggs were secured on October 8 and the last on November 12. The yield amounted to 408,461, but on account of trouble with the water supply, which necessitated the changing of the location of the hatchery when the eggs were at a critical stage, the loss was great. The eggs were transferred to St. Johnsbury as soon as eyed and produced 150,000 fry for distribution.

Arrangements were made, as usual, to collect eggs from trout in Fairbanks Pond. About 50,000 were secured, of which 27,500 proved good.

The Wells River Fish and Game Club ponds are about an hour's drive from Wells River, and when well stocked will prove a profitable field for work. About 17,000 eggs were secured there in October.

Arrangements were entered into with Hon. S. L. Griffith, at Danby, to collect eggs from his pond on shares. Mr. G. H. Tolbert was placed in charge of the work at that point. The Commission was to receive 200,000 eyed eggs for his services, but owing to defective arrangements the results were unsatisfactory, so that Mr. Griffith was obliged to purchase 1,000,000 eggs from one of the commercial hatcheries in Massachusetts. Of these, 200,000 were turned over to the Commission.

Arrangements were made to take both lake and brook trout eggs at Caspian Lake. A large pound net was purchased, and two fishermen from Lake Champlain were engaged to operate it. Owing to unexpected delays the net was not placed in the water until October 15, and on the

18th two ripe lake trout were captured, one male and one female; another was taken subsequently, and 17,500 eggs were secured. The location of the net was changed three times during the season, and nearly every night loosely hung gill nets of small mesh were set in various portions of the lake, in both deep and shallow water. Although the men worked nearly 16 hours per day, it became evident by November 1 that it was useless to continue the work. Large quantities of suckers, small minnows, dace, and smelt were taken.

The brook trout did not appear on the spawning-beds as usual in November, which is accounted for by the fact that the water 4 feet below the surface was much warmer than usual, registering 50° on October 25. The station was closed in November with most disappointing results, the collections amounting to only 17,500 lake trout and 6,500 brook trout eggs. It is believed, though, that the lake trout had spawned before fishing commenced with the pound net.

In order to determine whether the brook trout spawned after work was discontinued the spawning-beds were examined on December 1 and 28. The first examination showed the presence of two pairs; the last disclosed three beds which had just been cleaned. Other examinations were prevented by the extreme cold weather, the temperature standing at 12° below zero.

On October 22 the superintendent visited Lake Dunmore to determine whether it would be advisable to establish a station there for collecting lake-trout eggs. A suitable spring for eying a million or more was found near the lake, and a number of males and females were observed on the beds. A female, estimated to weigh 10 pounds, taken with a dip net, was found to be full of ripe eggs. It is believed that with suitable apparatus enough fish could be captured to yield a million or more eggs during the season at comparatively light expense.

As a result of the operations at the various points, 950,000 eyed eggs were received at St. Johnsbury at a cost of $1,000; 370,000 of these were transferred to other stations of the Commission and shipped to State fish commissions and private individuals; and 580,000 were hatched at the station, the fry resulting from them being distributed in May and June.

In addition to the eggs collected at the field stations, 9,000 eggs of the golden trout were obtained from the New Hampshire Fish Commission and hatched at St. Johnsbury for the Vermont Commission. A shipment of 50,000 landlocked salmon eggs, transferred from Craig Brook on March 22, arrived with a loss of only 17. These hatched in May, and 42,329 remained of them at the close of the year. Owing to the high temperature of the water, it was found necessary to put salt in the ponds twice a week. Before doing this the water is drawn down very low and the supply shut off; the fish are then immersed in a solution of about 4 quarts of salt to 40 gallons of water.

During June two consignments of grayling eggs were received from Bozeman, Mont. On account of the warm weather prevailing at that time and lack of attention en route both lots arrived in poor condition, only 1,000 eggs being saved from the first shipment and 7,000 from the second. At the close of the year the fry resulting from them were being fed on finely grated liver, and were apparently healthy.

During the spring 2,000,000 pike-perch eggs were received from the Missisquoi River, and the fry resulting, about 250,000, were planted in Joe's Pond, near West Danville, Vt., and Silver Lake at Barnard.

The fish food used at the station consists principally of beef livers. Such waste material as could not be utilized in the ordinary method was used for developing insect larvæ. An odorless maggot box was devised, consisting of a floating box tightly closed with a cover, the lids extending down to the water, with a bottom of coarse wire cloth covered with excelsior or straw, upon which the meat is placed. As the maggots hatch out they work down through the excelsior and drop out into the water, where the fish are lying in wait for them.

At the request of Prof. J. W. Moenkhaus, of Cambridge, Mass., the eggs of two brook trout were fertilized with milt of two lake trout during the month of November. After supplying Professor Moenkhaus with such specimens as he required, the balance of the eggs were hatched at the station with slight loss, and on July 1 there remained 2,241 healthy fry. These hybrids were of the same size as the brook-trout fry, but resembled the lake trout in nature and markings. A larger number of deformities occurred among these than is usual with either the lake or brook trout. A notable feature consisted in not having a tail, or at least a very slight tail compared with the body.

The condition of the water supply of the station is practically the same as heretofore. Efforts were made to increase it by driving wells, under an act of Congress authorizing an expenditure of $3,000. Five wells were driven, but only one yielded any water.

During July the superintendent's residence was completed. A new pond was constructed and nursery ponds No. 7 to No. 12 were turfed and plank walks built around them.

CAPE VINCENT STATION, NEW YORK (LIVINGSTON STONE, IN CHARGE).

On account of the unusually stormy weather prevailing in October and November no lake-trout eggs were collected on Charity Shoals or any of the near-by fishing grounds, but arrangements were made to conduct operations at Dunkirk during November, and from this source 822,500 eggs were secured. These hatched the following spring with a loss of 346,505, and the 425,000 fry obtained from them were planted in Lakes Ontario and Otsego.

In December 15,000,000 white-fish eggs were transferred from Put-in Bay. These were collected at Monroe Piers, Michigan, under unfavorable conditions, and were of very poor quality. The fry hatched in April, and were planted in Lake Ontario. During the winter several shipments of brook-trout eggs, amounting to 361,480, were purchased from private hatcheries in Massachusetts. The fry from these were distributed in the spring to private applicants in New York.

All efforts to collect pike-perch eggs from Lake Ontario and tributary waters having failed, arrangements were made early in the spring to establish a collecting station on the Missisquoi River, in northern Vermont, which has always been noted for the abundance of its pike perch. As soon as the ice disappeared the fish commenced ascending the river in vast numbers as far as Swanton Dam, 7 miles above its mouth. The point selected for a fishing-ground is on the right-hand bank of the Missisquoi River, about 3 miles below Swanton Dam, the site of a former fishing-ground. A small wharf and spawning shanty were erected near where the seine would be landed, and pens were constructed for holding the spawning fish preparatory to stripping them.

As soon as the ice broke up the capturing of the fish was commenced with the ordinary haul seines, and by April 28 over 3,000 had been secured. This number might have been doubled had the operations been conducted during the night. The first eggs were stripped on April 23, and the last on April 28, the 591 females available yielding 38,000,000, of which 36,000,000 were sent to Cape Vincent and the remainder to St. Johnsbury. The methods of stripping and fertilizing the eggs were practically the same as at Put-in Bay and other stations where pike perch are handled. They were sent from Swanton to Cape Vincent on trays and in cans of water, and from the condition in which the different lots were received it would appear that better results can be secured by shipping on trays. From the 36,000,000 eggs derived from Swanton and 24,000,000 transferred from Put-in Bay, only 9,050,000 fry were hatched. Of these, 25 per cent were returned to the Missisquoi River and planted on the fishing-grounds; the balance were distributed in the State of New York. It is believed the poor results were due largely to the holding of the fish in pens too long before they were ripe. The outlook for the collection of several hundred million eggs at this point in the future is excellent, and arrangements will be made next year to conduct operations on a much larger scale.

Investigations during the previous spring having indicated that there were no points on Lake Ontario where a sufficiently large number of sturgeon could be obtained to warrant the establishment of a field station, arrangements were made this season to thoroughly investigate the Lake Champlain fisheries, as it had been reported that large numbers were being taken on that lake. Mr. Myron Green, who was employed to assist in the work, reported on May 17 that a great many were being captured at East Alburg, Vt., and that he had 16 large ones penned. An examination showed that none of these were ripe, but three of them would probably have spawned within three or four weeks. Arrangements were made with the fishermen to examine all the sturgeon caught, and in several instances females that appeared to be nearly ripe were penned and held. During the latter part of the month most of the fish captured seemed to be less matured than those taken early in the season. Concluding that the point selected for operations was at some distance from the spawning-beds, all of the sturgeon captured for 25 miles south of Alburg, nearly down to Burlington, were overhauled, but without results. All efforts to collect eggs were abandoned late in June, as the sturgeon seemed to have left the shoal water and to have gone into the deeper portions of the lake. From the data collected this spring it is impossible to determine definitely whether or not sturgeon ascend the river to deposit their eggs. They appear in the Missisquoi River immediately after the spawning of the pike perch and suckers, going up as high as the Swanton Dam, when they suddenly disappear, the stay at Swanton never being over 6 days and sometimes not over 3 days.

The development of regular sturgeon fishing in Lake Champlain is recent, and is probably due to the sudden rise in the commercial value of the fish. The flesh brings 12½ cents per pound net to the fishermen in New York, and the eggs from 65 to 75 cents per pound. A sturgeon dressing 100 pounds and yielding 24 pounds of eggs readily brings $30. They are usually captured with gill nets of 11-inch mesh, which vary in length from 20 rods to a mile or more. By means of a 400-rod net 30 were captured in one week.

Though all efforts this year resulted in failure, it is believed that some eggs may be collected next year by setting nets in the Missisquoi and Lamoille rivers, as soon as the pike perch have spawned, capturing all the sturgeon that ascend and holding them in confinement in a suitable pound until they ripen.

The following table shows the number of eggs received at Cape Vincent during the season and the fry hatched and distributed:

Species.	Eggs received.	Fry distributed.
Lake trout	822,500	425,000
White-fish	15,000,000	5,000,000
Pike perch	60,000,000	9,050,000
Brook trout	361,480	200,000

GLOUCESTER STATION, MASSACHUSETTS (C. G. CORLISS, SUPERINTENDENT).

During the summer, in addition to various minor repairs to buildings and water-circulating plant, a 1-story storage shed, 38 by 26 feet, and a small oil and paint house, 7 by 7, were erected. The old supply tank, which had been condemned, was replaced by a new cypress tank of 15,000 gallons capacity, and the platform was raised 5 feet to secure greater pressure for hatching lobster eggs.

Shortly after the completion of this work preparations were made for the collection of cod eggs at Kittery Point, Maine, under the direction of Capt. E. E. Hahn, of the schooner *Grampus*. A small force was also stationed at Plymouth, Mass., under the immediate direction of Mr. F. S. Conley. The first eggs from Kittery were received November 21, and the last on March 28, the total collections from that source amounting to 104,000,000. The shipments from Plymouth aggregated 61,618,000, the last consignment being received April 4. From Kittery 1,559,000 pollock eggs were also received, which produced 834,000 fry.

From the cod eggs collected at Kittery and Plymouth 106,455,000 fry were hatched and planted on the natural spawning-grounds between Kittery and Boston Bay. The following shows the daily collection of cod eggs, the loss during incubation, and the fry hatched and planted:

Date of taking eggs.	No. of eggs received.	Loss during incubation.	No. of fry hatched and planted.	No. of eggs planted.
1898.				
Nov. 21	2, 290, 000	355, 000		1, 935, 000
24	827, 000	102, 000		725, 000
25	2, 583, 000	233, 000		2, 350, 000
29	711, 000	212, 000	499, 000	
Dec. 1	369, 000	94, 000	275, 000	
2	474, 000	116, 000	358, 000	
6	664, 000	167, 000	497, 000	
7	829, 000	142, 000	687, 000	
8	1, 112, 000	332, 000	780, 000	
10	2, 949, 000	807, 000	2, 142, 000	
11	6, 163, 000	1, 866, 000	4, 297, 000	
12	379, 000	139, 000	240, 000	
13	554, 000	332, 000	222, 000	
14	4, 980, 000	1, 213, 000	3, 767, 000	
15	3, 916, 000	849, 000	3, 067, 000	
16	5, 992, 000	1, 508, 000	4, 484, 000	
17	2, 989, 000	1, 193, 000	1, 796, 000	
18	3, 455, 000	1, 224, 000	2, 231, 000	
19	2, 220, 000	1, 177, 000	1, 043, 000	
21	1, 373, 000	169, 000	1, 204, 000	
22	1, 137, 000	300, 000	837, 000	
24	1, 589, 000	384, 000	1, 205, 000	
25	1, 535, 000	234, 000	1, 301, 000	
26	231, 000	28, 000	203, 000	
30	521, 000	59, 000	462, 000	
1899.				
Jan. 3	8, 031, 000	2, 740, 000	5, 291, 000	
4	5, 021, 000	1, 267, 000	3, 754, 000	
8	1, 847, 000	737, 000	1, 110, 000	
9	1, 231, 000	426, 000	805, 000	
12	3, 247, 000	1, 261, 000	1, 986, 000	
13	1, 326, 000	435, 000	891, 000	
16	7, 582, 000	2, 485, 000	5, 097, 000	
17	852, 000	346, 000	506, 000	
19	2, 509, 000	791, 000	1, 718, 000	
20	190, 000	15, 000	175, 000	
23	308, 000	16, 000	292, 000	
26	2, 535, 000	711, 000	1, 824, 000	
29	545, 000	251, 000	294, 000	
30	2, 131, 000	1, 350, 000	781, 000	
31	1, 848, 000	661, 000	1, 187, 000	
Feb. 2	1, 255, 000	521, 000		734, 000
5	4, 171, 000	2, 153, 000		2, 018, 000
6	2, 652, 000	745, 000		1, 907, 000
19	5, 094, 000	1, 113, 000	3, 981, 000	
20	4, 763, 000	1, 223, 000	3, 540, 000	
21	1, 397, 000	641, 000	756, 000	
22	735, 000	178, 000	557, 000	
23	5, 803, 000	1, 526, 000	4, 277, 000	
24	2, 297, 000	608, 000	1, 689, 000	
25	1, 966, 000	919, 000	1, 047, 000	
26	9, 260, 000	2, 446, 000	6, 814, 000	
28	4, 783, 000	1, 364, 000	3, 419, 000	
Mar. 1	4, 902, 000	1, 264, 000	3, 638, 000	
2	853, 000	294, 000	559, 000	
6	4, 502, 000	692, 000	3, 810, 000	
9	6, 586, 000	2, 284, 000	4, 302, 000	
11	1, 232, 000	165, 000	1, 067, 000	
13	1, 256, 000	346, 000	910, 000	
15	852, 000	163, 000	689, 000	
18	1, 692, 000	372, 000	1, 320, 000	
21	5, 472, 000	2, 118, 000	3, 354, 000	
22	1, 422, 000	1, 149, 000	273, 000	
28	1, 113, 000	549, 000	564, 000	
Apr. 3	1, 303, 000	109, 000	1, 194, 000	
4	948, 000	104, 000	844, 000	
6	948, 000	415, 000	533, 000	
Total for season	166, 302, 000	50, 188, 000	106, 445, 000	9, 669, 000

The season was remarkable for the many severe storms and extremely cold weather prevailing during the greater part of the winter. This not only interfered materially with collecting operations along the coast, but on account of accidents to the supply pipes it became necessary on two occasions to plant all eggs and fry on hand and to suspend all operations until the pipes could be repaired. The first heavy storm occurred November 27, and resulted in the wrecking of several vessels on Ten-Pound Island and in the almost total destruction of the pier. During this gale the suction pipe was broken, and the 5,010,000 cod eggs in the hatchery at the time had to be planted, as the water supply was cut off. During the greater part of February the weather was so cold that the harbor froze over for quite a distance from Ten-Pound Island on several occasions, and, notwithstanding all precautions, the supply pipe froze, and for a second time the water supply was cut off. Towboats were hired and the pipe thawed out, but it froze again in a few days, again making it necessary to plant all eggs and fry.

In view of the rapid decline of the lobster fishery, arrangements were made early in the season for the collection of lobster eggs from all of the important points between Boston and Eastport, Me., the active cooperation of the Massachusetts, New Hampshire, and Maine State Fish Commissions being secured. Collections along the Maine coast commenced in April, under the direction of Captain Hahn, with the schooner *Grampus*, assisted by a steam smack. The results were much better than in past years, over 34,348,000 eggs being secured from this field, an increase of more than 12,000,000 over last season. From fishermen in the vicinity of Gloucester 10,120,000 eggs were obtained, and from Boston, 21,064,000; Kittery Point and its vicinity yielded 11,858,000, making a total for the season of 77,390,000. Of the fry hatched, amounting to 70,610,000, 36,925,000 were planted along the Maine coast, at various points selected by the commissioner of shell fisheries. They were very successfully shipped by rail in care of a messenger to Portland, from which point they were distributed by the *Grampus* and the steam smack. The *Grampus* also took several shipments, amounting to over 8,000,000, from the station. The remaining fry, amounting to 33,685,000, were distributed in Massachusetts waters by means of the steam launch chartered for the collection of adult lobsters in the vicinity of Boston and Gloucester. The first lobster eggs were collected on April 27; the last on July 16. The fry commenced hatching about the first of June and continued until July 28, when the last plant was made.

The following table shows the number of eggs of each species received, and the fry hatched and distributed during the season:

Species.	Eggs received.	Fry hatched.
Cod	166,302,000	106,445,000
Pollock	1,559,000	834,000
Lobster	77,390,000	70,610,000
Total	245,251,000	177,889,000

WOODS HOLE STATION, MASSACHUSETTS (E. F. LOCKE, SUPERINTENDENT).

During the summer a number of repairs and improvements were made to the buildings and equipment, including the substitution of a wooden roof for the old iron one on the coal shed, the painting of the residence, and putting in new plumbing. A new boiler was also placed in the *Cygnet*, and the *Blue Wing* was provided with a new crank shaft. The laboratory was kept open during the entire year, and in July and August was taxed to its utmost capacity.

Following the usual methods, the collection of brood cod was commenced about October 1 by the *Grampus*, the first lot being received at the station October 11. Work was continued until November 15, during which time the schooner delivered 2,485 cod, varying in size from 6 to 20 pounds; and this collection was still further increased by the purchase of 349 from some of the commercial fishermen. All of the fish were delivered in excellent condition. They were fed on freshly shucked clams during the winter and appeared to thrive on them. The first ripe fish were found November 14, and collections continued daily from that time until February 10, when all of the brood-fish on hand were killed by the extremely cold weather. The total collections from these fish amounted to 102,223,000 eggs.

In addition to eggs collected from fish at the station, 54,380.000 were obtained at Plymouth by a crew of men stationed at that point under the direction of Mr. F. S. Conley. Operations were to have commenced in November, but owing to the fact that the steam launch *Blue Wing*, which had been detailed for that work, was unable, on account of the stormy weather, to report until December 12, no eggs could be delivered at the station from that point before the 13th. The season was very unfavorable, owing to the extremely cold weather and the numerous storms that prevailed along the coast during December and January.

As a result of the operations at the two points, 156,603,000 eggs were received and 92,143,000 fry hatched. These were all liberated in Vineyard Sound near Gay Head, except a few released in Buzzards Bay when the weather was so rough that the vessel used in making the plants could not reach that point.

Table showing the number of cod eggs collected, daily losses in incubation, and fry hatched.

Date eggs were received.	Number of eggs received.	Loss during incubation.	Fry hatched.	
			Number.	Date.
1898.				1898.
Nov. 14	711,000	194,000	457,000	Nov. 23
16	1,184,000	221,000	794,000	26
18	1,231,000	289,000	648,000	28
21	4,168,000	780,000	2,681,000	Dec. 3
22	2,273,000	457,000	1,394,000	5
23	3,505,000	640,000	2,303,000	5
25	3,790,000	1,013,000	2,197,000	11
29	3,267,000	1,041,000	1,925,000	18
Dec. 1	4,831,000	1,533,000	2,771,000	20
2	3,553,000	898,000	2,404,000	21
6	5,310,000	1,329,000	3,435,000	26
8	5,825,000	1,586,000	3,799,000	28
10	4,169,000	1,668,000	2,333,000	29

Table showing the number of cod eggs collected, etc.—Continued.

Date eggs were received.	Number of eggs received.	Loss during incubation.	Fry hatched.	
			Number.	Date.
1898.				1899.
Dec. 13	3, 439, 000	968, 000	2, 248, 000	Jan. 2
14	1, 100, 000	537, 000	269, 000	3
15	9, 212, 000	5, 910, 000	2, 954, 000	3
16	7, 152, 000	2, 559, 000	4, 281, 000	5
17	3, 220, 000	896, 000	2, 066, 000	6
19	5, 091, 000	1, 928, 000	2, 846, 000	8
21	3, 836, 000	1, 355, 000	2, 266, 000	10
22	971, 000	247, 000	608, 000	12
24	4, 596, 000	2, 098, 000	2, 199, 000	14
27	1, 588, 000	479, 000	1, 003, 000	16
29	5, 164, 000	2, 126, 000	2, 605, 000	17
31	4, 477, 000	1, 762, 000	2, 272, 000	19
1899.				
Jan. 3	3, 056, 000	2, 343, 000	478, 000	24
5	3, 696, 000	906, 000	2, 472, 000	25
7	4, 210, 000	1, 383, 000	2, 321, 000	28
9	6, 392, 000	1, 412, 000	4, 657, 000	29
13	3, 496, 000	704, 000	2, 647, 000	Feb. 2
14	2, 394, 000	189, 000	2, 130, 000	3
16	10, 160, 000	2, 337, 000	7, 042, 000	5
17	2, 297, 000	488, 000	1, 666, 000	7
19	1, 288, 000	532, 000	693, 000	8
20	2, 510, 000	531, 000	1, 758, 000	9
21	3, 790, 000	1, 300, 000	2, 215, 000	10
22	3, 696, 000	1, 126, 000	2, 172, 000	11
23	5, 617, 000	1, 614, 000	3, 434, 000	12
24	4, 361, 000	1, 823, 000	2, 148, 000	12
Feb. 4	1, 113, 000	873, 000	108, 000	Mar. 3
Mar. 21	1, 706, 000	487, 000	1, 062, 000	Apr. 10
22	758, 000	239, 000	497, 000	10
26	2, 400, 000	252, 000	1, 895, 000	13
Total	156, 603, 000	51, 053, 000	92, 143, 000	

Continuing the system adopted the previous season, as soon as the fish had finished spawning they were tagged with small aluminum tags and released, 597 being disposed of in this way, and at the close of the fiscal year reports had been received of the capture of 17 by commercial fishermen, at points along the coast from off Chatham and Georges Bank on the north to Amagansett, Long Island, on the south.

Owing to intensely cold weather from February 9 to 15, closing all harbors and bays in the vicinity of the station, the fyke nets for the capture of flat-fish could not be set in Waquoit Bay until February 23, and then only after breaking considerable ice. Nets were also set in Great and Little Woods Hole harbors. Most of the fish captured in February were spent. 341 were taken at Waquoit Bay on March 11, but nearly all of them had spawned. Mr. J. B. Rogers was ordered to East Greenwich, R. I., on March 8, to collect eggs from fish taken at that point. From February 26 to April 21 94,792,000 were received at the station, 26,125,000 of them resulting from 90 fish taken at Waquoit, 29,099,000 from 81 fish captured around Woods Hole, and the remainder from 145 fish taken at East Greenwich, R. I. The eggs obtained early in the season, though treated as in former years, were poor, a large proportion being unimpregnated. The unfertilized ones were found in the middle of clusters. A number of methods were tried in handling, but the best results were obtained by taking them in water in shallow dishes, putting only enough eggs in a dish to cover the bottom. They were then allowed to stand about two hours, at the expiration of which time they were found in sheets about the thickness of ordinary window glass. These sheets were broken up, measured, and placed in the Chester jars and yielded a fair percentage of fry. In all 52,441,000 were hatched, 5,000,000 of which were shipped to East Greenwich, R. I. The remainder were planted in and around Woods Hole Harbor.

Large numbers of small flat-fish from $\frac{3}{8}$ inch to $\frac{7}{8}$ inch in length were captured during the spring in surface nets near the station, and while it is impossible to say whether or not these were the results of Fish Commission operations, it would seem reasonable to so claim.

In April arrangements were made to obtain egg lobsters from the fishing centers between Noank, Conn., and Scituate, Mass. The launch *Cygnet* was detailed to collect from fishermen operating in Vineyard Sound and Buzzards Bay and a schooner was employed to cover the field around Noank and Stonington, Conn., and Block Island, R. I. This boat was also used in planting fry and adult lobsters in Connecticut waters after the eggs had been hatched. At Plymouth and Scituate local men were engaged to collect and ship the lobsters to the station by express. The work was pushed energetically to the close of the fiscal year, at which time 18,498,000 eggs had been obtained from Noank, Stonington, and Block Island, 11,760,000 in the vicinity of Woods Hole, including Buzzards Bay, 298,000 from Plymouth, Mass., 2,491,000 from Scituate, Mass., and 11,411,000 from Newport, R. I. The collections from the first three points mentioned were a little behind those of last season; those from Woods Hole and vicinity averaged about the same, while the Plymouth collections were only about 7 per cent of the take of 1898. The decrease resulted from fishermen taking less interest in the work. The Newport field is a new one, and it is believed that next year's collections at that point can be made to double this year's.

As there is no law in Rhode Island which prohibits the sale of egg lobsters, arrangements were made to pay dealers for the privilege of stripping the eggs, after which they were returned to them to be sold. From the 44,458,000 eggs collected, 39,881,000 fry were hatched and planted over a wide territory. All of the adult lobsters handled, except those at Newport, were liberated in open waters.

A pound net was set in Buzzards Bay to obtain mackerel eggs, and from May 29, when the first haul was made, to the end of June 4,918,000 apparently good eggs were secured, but they produced only a few fish. This was disappointing, as nearly all of the eggs developed to a point where, by aid of the microscope, the pulsations of the heart were plainly visible and the embryo could be seen to twist and turn in the egg.

The following shows the number of eggs collected and fry hatched during the season:

Species.	Number of eggs collected.	Number of fry hatched.
Cod	156,603,000	92,143,000
Flat-fish	94,792,000	52,441,000
Lobster	44,458,000	39,881,000
Mackerel	4,918,000	....

STEAMER FISH HAWK (JAMES A. SMITH, COMMANDING).

On March 18 the vessel left Edenton, N. C., and anchored at the entrance to the Chowan River, near the mouth of Salmon Creek. Two days after her arrival, the hatching apparatus having been installed, spawn-takers were sent to the various fishing shores and pound nets, but for two or three weeks the conditions were unfavorable, the weather being cold and rainy and the water temperature ranging from 47° to 56°. The first shad eggs were obtained March 27, but though daily trips were made to all the seines and pounds in the vicinity, no further collections were made until April 5, when 209,000 eggs were secured from Dr. W. R. Capehart's seine at Avoca. A few eggs were obtained each day until the 15th, when the water temperature rose to 58°. On that date 1,234,000 were collected at Dr. Capehart's seine and 269,000 from a seine operated by T. D. Holly in the Upper Chowan. From the 15th to the 30th good collections were secured, aggregating 21,267,000 eggs, from which 13,898,000 fry were hatched. As in past years, most of the eggs were obtained from Capehart's fishing shore, though efforts were made to secure them from pound nets on the north shore of the Chowan, from the seines on the Roanoke, and also the Upper Chowan. The largest take in any one day was on April 28, when 2,487,000 were collected at the Capehart fishery. The vessel at that time was lying in Edenton Harbor and the eggs were transferred by steam launch.

For the purpose of testing the water of Pembroke Creek, where a site for a new shad station had been purchased, experiments were conducted on board the *Fish Hawk*, during April, in hatching shad eggs in water under closed circulation. The results were unsuccessful, and on April 28 the vessel proceeded to Edenton and anchored in the harbor. G. L. Hopper was placed in charge of a temporary plant erected on Pembroke Creek, and 375,000 impregnated eggs were transferred from the ship and placed in jars at that point. By April 30, at noon, 307,000 of the fry had been hatched and deposited in the creek near the station. The experiment was entirely successful, proving beyond doubt the suitability of the water of Pembroke Creek for hatching shad eggs. When the vessel left on May 1 there remained 4,147,000 eggs, and in order to avoid transferring these, arrangements were made with the Edenton Ice and Storage Company to erect a temporary plant on its grounds. A shed of rough boards was put up, and a table with the necessary tanks, jars, pipes, etc., installed. The eggs were then transferred from the vessel and hatched, and the fry resulting from them, 3,652,000, were deposited in Edenton Harbor.

The vessel arrived at Gloucester City, N. J., on May 11 at 9 a. m. The same evening 3,000,000 shad eggs were collected by spawn-takers from Howells Cove, Bennett's fishing shore, and the gill nets at Billingsport and Cramer's fishery, above Philadelphia. Work continued uninterruptedly until June 3, during which period 51,983,000 eggs were obtained. These produced 31,731,000 fry, which were planted in waters of Delaware, New Jersey, New York, and Connecticut. In addition to these, 2,200,000 fertilized eggs were deposited on the spawning-grounds at Howells Cove and 5,475,000 were transferred to other stations, 3,765,000 being sent to the Bristol hatchery, which is operated by the Pennsylvania Commission. These transfers were necessary, as the apparatus on the vessel was inadequate for hatching all the eggs taken. Howells Cove yielded the greatest number of eggs, 22,737,000 coming from that field; Bennett's fishery yielded 13,551,000; the remainder were obtained from the Cramer Hill fishery and gillers.

As the term of enlistment of some of the crew expired in May, it was necessary to employ seven additional men to assist in spawn-taking and hatching. On June 3 the collecting was discontinued, but the last of the fry were not hatched until June 8. On that date the fish-cultural apparatus was dismantled, and on the 12th the vessel proceeded to Woods Hole, where it reported to Dr. H. C. Bumpus.

BATTERY STATION, MARYLAND (ALEXANDER JONES, IN CHARGE).

A part of the temporary force was engaged on April 1 and the work of fitting up the hatchery, overhauling the boats, machinery, etc., commenced. By the 10th the station was in readiness for the reception of eggs, and when the first collections came in the force was increased to 43 men, the largest number employed at this station in many years. During the previous summer a number of minor repairs were made to the buildings and launches, and the capacity of the hatchery, which had been severely tested during the past two seasons, was increased by the erection of a line of shelves along its sides and ends, providing room for 180 additional jars, and giving the hatchery an aggregate capacity for 50,000,000 shad eggs. This extension proved insufficient, however, to accommodate the great numbers of eggs that came in during the season, and a further enlargement was necessary. A shed 10 feet wide and 60 feet long was erected on the south side of the building, in which 8 tables, holding 224 jars, were set up. By this means the capacity of the station was increased to about 70,000,000.

The prospects at the beginning of the season were very unfavorable, as the temperature of the water remained low, and fish were reported to be very scarce down the bay. The first eggs came in April 19, and collections gradually increased from that time until the 24th, when 16,845,000 were taken. The daily average was one to nine millions until June 2, when the appearance of salt water terminated the work. The total number of eggs reported was 185,058,000, though the actual number received probably exceeded 200,000,000.

The majority of the eggs are purchased from the fishermen, and as many of them are dead when brought in, and as it is impossible to always determine which are dead without the aid of a microscope, they were not measured until they had been in the house from 12 to 24 hours. This practically insured reporting only fairly good eggs. The regular spawn-takers took 35,000,000 during the season; the remainder, except 1,700,000 transferred from the *Fish Hawk*, were purchased from fishermen on the same basis as heretofore, at $20 per 1,000,000.

Some of the best collecting fields were several miles from the station, and as it was impossible for the launches and spawn-takers to attend these regularly, auxiliary stations were established—one in Northeast River, one at Havre de Grace, and one in the narrows—for the purpose of receiving eggs obtained by the fishermen in those localities. The eggs so obtained were either brought to the station at once by the men in charge of the auxiliary station or held until they could be called for next day by the launches. This arrangement was inexpensive and worked very satisfactorily. The number of fishermen furnishing eggs has increased each year, and during the past season over 100 boats were engaged in the work.

The quality of the eggs was excellent, over 125,596,000 fry being hatched. 2,800,000 eyed eggs were transferred to Central Station, 5,500,000 were sent to the State hatchery at Bristol, Pa., and 10,930,000 were planted on the spawning-grounds.

The following table shows in detail the daily collections and losses, number of fry hatched and planted, and period of incubation:

Date.	Eggs.		Fry.		Date of hatching.	Eggs shipped.
	Taken.	Lost.	Hatched.	Planted.		
1899.						
Apr. 19	68,000	68,000				
20	182,000	57,000	125,000	125,000	Apr. 29	
21	538,000	438,000	100,000	100,000	29	
22	1,705,000	605,000	1,100,000	1,100,000	29	
23	4,480,000	1,245,000	3,235,000	3,235,000	May 1	
24	16,845,000	7,740,000	9,105,000	9,105,000	2	
25	9,005,000	3,700,000	3,805,000	3,805,000	2	1,500,000
26	5,720,000	1,095,000	4,625,000	4,625,000	2	
27	5,795,000	715,000	5,080,000	5,080,000	3	
28	4,100,000	325,000	975,000	975,000	3	2,800,000
29	5,715,000	1,070,000	2,645,000	2,645,000	3	2,000,000
30	4,363,000	913,000	3,450,000	3,450,000	5	
May 1	4,250,000	1,155,000	3,095,000	3,095,000	5	
2	845,000	80,000	765,000	765,000	6	
4	2,575,000	340,000	2,235,000	2,235,000	8	
5	2,250,000	290,000	1,960,000	1,960,000	9	
6	540,000	135,000	405,000	405,000	10	
7	3,315,000	510,000	2,805,000	2,805,000	11	
8	6,930,000	1,200,000	5,730,000	5,730,000	13	
9	1,955,000	295,000	1,660,000	1,660,000	13	
10	3,056,000	516,000	2,540,000	2,540,000	14	
11	7,625,000	700,000	6,925,000	6,925,000	15	
12	4,950,000	300,000	4,650,000	4,650,000	16	
13	5,855,000	440,000	5,415,000	5,415,000	18	
14	4,465,000	190,000	4,275,000	4,275,000	18	
15	4,435,000	700,000	3,735,000	3,735,000	19	
16	2,055,000	125,000	1,930,000	1,930,000	20	
17	1,190,000	115,000	1,075,000	1,075,000	21	
18	3,270,000	185,000	3,085,000	3,085,000	22	
19	2,385,000	190,000	2,195,000	2,195,000	25	
20	2,120,000	235,000	1,885,000	1,885,000	26	
21	2,000,000	110,000	890,000	890,000	27	100,000
22	2,645,000	2,750,000	2,370,000	2,370,000	28	
23	4,385,000	525,000	3,860,000	3,860,000	29	
24	4,135,000	664,000	3,471,000	3,471,000	30	
25	9,485,000	2,780,000	6,705,000	6,705,000	31	
26	1,710,000	1,050,000	660,000	660,000	June 1	
26	7,780,000	2,615,000	5,165,000	5,165,000	1	
27	8,211,000	2,541,000	4,745,000	4,745,000	2	925,000
28	7,845,000	2,290,000	2,645,000	2,645,000	2	2,910,000
29	5,475,000	480,000	1,580,000	1,580,000	3	3,415,000
30	3,975,000	765,000	1,110,000	1,110,060	4	2,100,000
31	3,635,000	445,000	1,610,000	1,610,000	5	1,600,000
June 1	215,000	40,000	175,000	175,000	5	
2	980,000					98,000
Total	185,058,000	40,232,000	125,596,000	125,596,000		19,230,000

Early in the season 40 cases of herring roe were canned, to be used as fish food at the Wytheville and Erwin stations. An immense amount of this roe is wasted every year, and as it is considered an especially suitable food for young rainbow trout it is recommended that a larger canning plant be installed before the opening of another season. The work of canning costs nothing, as it is done by the station force.

Attention is called to the condition of the marine railway for hauling out the launches. It is unsafe, and should be removed at once.

CENTRAL STATION, WASHINGTON, D. C. (J. E. BROWN, IN CHARGE).

The work of this station for the year has been conducted as usual, it being used as headquarters for the Fish Commission cars and as a receiving depot for the shipment of the output of the fish ponds. Eggs of salmon, trout, shad, and yellow perch were hatched at the station to demonstrate the methods of the Commission, forming an instructive and entertaining exhibit, for about eight months of the year, to the many visitors attracted to the aquarium.

The following table shows the number of eggs received and hatched:

Species.	Eggs received.	Fry hatched.
Shad	4,013,000	3,500,000
Brook trout	9,990	9,990
Rainbow trout	13,440	13,397
Atlantic salmon	4,990	4,225
Lake trout	12,000	11,128

The superintendent of Central Station is also charged with receipting for and shipping all freight and express received or sent by the Commission, and this work during the past year involved the handling of 749 packages received and 541 sent out.

The appearance of the station has been much improved recently by the installation on the ground floor of most of the exhibits used by the Commission at the various expositions, also a large variety of fishery apparatus, including not only domestic material but many forms from the Bergen Exposition, Norway.

BRYAN POINT STATION, MARYLAND (L. G. HARRON, IN CHARGE).

The storage shed and boathouse were whitewashed in March, and the boats and other equipment were painted and put in readiness for the coming season. On April 13 the launches *Petrel* and *Blue Wing* reported for duty, and at the first appearance of ripe shad (April 17) the force was increased to 45. The egg collections by April 30 aggregated 32,740,000, but the number of fish commenced falling off from that time, and on May 19 it became necessary to discontinue operations and dismiss the men, though a few were retained until the 25th to close the station. The collections amounted to 49,283,000 eggs, from which 37,384,000 fry were hatched and 4,062,000 eyed eggs transferred to other points. Of the fry, 6,110,000 were planted in Southern waters, and 31,274,000 in the Potomac River on the natural spawning-grounds.

The following table shows the daily collection of eggs, fry hatched, eggs shipped, and air and water temperatures for the season:

Date.	Eggs received.	Eggs hatched.	Eggs shipped.	Temperature.		Date.	Eggs received.	Eggs hatched.	Eggs shipped.	Temperature.	
				Mean air.	Mean water					Mean air.	Mean water.
				°	°					°	°
Apr. 15	426,000	....	....	68	56	May 6	732,000	1,962,000	513,000	65.33	68
17	610,000	....	....	52	55	7	608,000	....	....	68.33	68
18	1,158,000	....	....	58.66	56	8	689,000	1,910,000	....	68.33	68.33
19	4,616,000	....	....	65.66	58	9	566,000	....	....	69	68.33
20	5,327,000	....	....	66.66	58.66	10	1,200,000	1,939,000	....	70.66	69
21	2,663,000	....	230,000	65	59	11	622,000	644,000	....	69.66	68.66
22	3,374,000	....	....	58.33	60	12	1,028,000	525,000	....	72.66	69
23	2,974,000	803,000	....	66	60	13	279,000	600,000	....	71.33	69
24	3,095,000	952,000	....	70.66	62.33	14	359,000	....	....	71.66	70.33
25	3,135,000	....	....	73.66	64	15	1,004,000	526,000	....	70.33	69
26	1,542,000	918,000	....	70.33	65.66	16	588,000	1,589,000	....	76.66	70.66
27	1,142,000	3,170,000	2,401,000	68.66	66.66	17	519,000	926,000	812,000	71.33	70
28	1,175,000	3,668,000	....	65.33	67	18	659,000	583,000	....	68	69.33
29	802,000	2,121,000	....	68.66	67.33	19	106,000	....	....	64	68
30	701,000	5,378,000	....	76	68.66	20	....	774,000	....	61.66	66
May 1	2,363,000	2,399,000	....	73.33	69.33	22	....	....	106,000	59.66	62.66
2	2,260,000	1,940,000	....	74.33	71.33	23	....	832,000	....	61	61.66
3	132,000	1,956,000	....	72	71						
4	1,595,000	645,000	....	65	69.33	Total ..	49,283,000	37,384,000	4,062,000	......	......
5	1,134,000	624,000	....	67.33	68.66						

As the tarred felt roof of the hatchery had commenced leaking, a shingle roof was substituted during the summer. In the following spring a sea wall, 120 feet long and 5 feet high, was built along the south side of the building to prevent the encroachment of the bank at its rear. The material used for this wall consisted of 8-inch cedar posts, 4 inches by 4 inches by 16 feet white-oak wales, and oak planks 2 inches thick. Another section, 32 feet long and 4 feet high, was built along the north side of the boiler house, and another along the north side of the cottage, to afford protection against the encroachments of the river. Considerable damage having resulted to the wharf during the winter, it became necessary to refloor it and to drive a number of white-oak piles at the corners as a protection against ice.

FISH PONDS AT WASHINGTON, D. C. (DR. RUDOLPH HESSEL, SUPERINTENDENT).

As a result of the work at this station during the fiscal year 44,465 large-mouthed bass, 160 small-mouthed bass, 3,662 crappie, and 3,000,000 shad were distributed in the fall months. Of the large-mouthed bass 39,000 were produced in the north pond, which has an area of about 3½ acres. The remaining 5,465 were taken from the west pond and are supposed to have been derived from a few late-spawners placed in one of the partitions of this pond in June. In view of the exceedingly poor results attained with the small-mouthed bass, it seems useless to continue experimenting with these fish at this station. Early in the summer the south pond, which has been devoted to their culture for several years, was estimated to contain about 4,000, but the number dwindled gradually and when the pond was drawn down in August only 160 remained.

The experiments with crappie were continued in ponds 20 and 5, and 3,662 were available for distribution in October. These were fed on young carp early in the season and subsequently on finely ground fresh fish.

A few common tench and gold-fish were reared for the aquarium at Central Station and for stocking fountains in public parks. The golden ide spawned as usual in April, but their eggs were destroyed by the cold weather.

The shad fry placed in the west pond in May, 1898, numbering 3,537,000, were held until October and then liberated. It is impossible to determine the exact number that passed out of the gates, but it was thought about 3,000,000 survived, as natural food was abundant in July, August, and September. As suitable food becomes very scarce in October, it is deemed advisable to liberate these fish hereafter in September.

Late in March the adult black bass were transferred from the retaining tanks, where they had been held through the winter, to the spawning partitions in the north and south ponds and ponds Nos. 6 and 7, from ten to fifteen being placed in each partition. They commenced spawning about the middle of April and continued until May 10, when all of the adults were taken out and placed in partitions in the west pond. The first young were observed five days after the eggs were deposited, the temperature at that time ranging from 62° at 7 a. m. to 72° at 4 p. m. As soon as the schools scattered the young fish were allowed to pass through the gateway of the spawning partitions to the large ponds, where, on account of the great abundance of natural food, their development was rapid, and on June 20 the work of transferring the larger ones to the rearing-tanks was commenced. They were captured in small-haul seines, all that were less than 2 inches in length being returned to the ponds, as it has been found by experience that it is difficult to make them take artificial food under that size. The indications at the close of the year point to a good crop of large-mouthed bass.

The following shows the water temperature in the north pond at 7 a. m. and 4 p. m., from April 20 to May 10, the spawning period:

Date.	7 a. m.	7 p. m.	Date.	7 a. m.	7 p. m.
	°F.	°F.		°F.	°F.
Apr. 20	63	70	May 1	72	81
21	61	70	2	75	83
22	64	78	3	77	82
23	64	64	4	69	77
24	62	72	5	70	71
25	60	76	6	67	68
26	62	78	7	67	70
27	60	76	8	68	70
28	50	67	9	67	74
29	49	67	10	69	77
30	68	80			

Early in April 60 adult crappie were placed in pond 2 and commenced spawning about the middle of that month. At the close of the year it was impossible to form any idea of the result, as these fish are very shy and remain hidden in dense watergrass at all times.

In ponds 21 and 22, set apart for the rearing of carp for fish-food, 150 spawners were placed, and as soon as they commenced to spawn (April 30) the spawning-beds were taken from the ponds and placed in tanks connected with the bass ponds, so that the young carp could pass freely into them as soon as they were needed. It is customary to introduce them when the bass have attained a length of an inch, but as the carp spawned much later than usual none were ready on May 16, when the bass had attained the requisite size. It is estimated that over 600,000 young carp were turned into the north and south ponds.

In May 2,700,000 shad fry were again placed in the west pond, to be held until September and liberated in the Potomac River.

AQUARIUM, CENTRAL STATION (L. G. HARRON, IN CHARGE).

During the summer, while the aquarium was closed, the interior of the grotto was repainted and dusted with stone dust, in imitation of Seneca stone. One of the nickel pumps used at the Omaha Exposition was installed in place of the hard-rubber pump, which was worn out, and a water motor was purchased to operate it in circulating the salt water. Other minor changes were made, including repairs to several of the large aquaria which had been broken during the summer.

In the fall a new supply of salt water was brought from Chesapeake Bay, near Old Point Comfort, and the usual collections of fishes and other marine animals were made, 415 specimens, representing 32 species, being procured and placed in the aquarium. Collections of sea anemone, star-fish, and lobsters were also received by express from the Gloucester, Mass., station. The majority of these specimens were kept until June without difficulty, the success attained being attributable in a large measure to improved facilities provided for the circulation of the salt water.

The ornamental fishes and species indigenous to this region, exhibited in the large tanks on the main floor of the building, were carried through the summer without difficulty. Special mention should be made of the 3-year-old large-mouth bass, which have been in the aquarium since they were taken from the ponds where they were hatched in 1897. During the year 2 died and 4 were used for scientific purposes, leaving 24 of the 30 still on exhibition. During the fall consignments of trout and salmon were received from Wytheville, Va., and Craig Brook, Me., and proved a most attractive display through the winter months. On June 1, the temperature having reached 71°, the trout were planted in suitable streams in Virginia and Maryland.

The principal food given the fish consists of round beefsteak and beef liver, the fat and sinew being removed and the meat cut in small pieces for the adult fish and ground in a meat-chopper for the small ones. The diet of the marine animals is changed from time to time by feeding chopped oysters or clams, fresh-water snails, and other crustacea, which form their natural food. Live minnows, small craw fish, and angleworms are provided in limited quantities for crappie and bass.

The following shows the salt and fresh water fishes exhibited during the year:

Salt-water fishes: Jumping mullet, spot or goody, tautog, croaker, sea bass, sea trout, rabbit-fish, swell-fish, toad-fish, bur-fish, pig-fish, blue-fish, flounder, red drum, moon-fish, remora, king-fish, cavally, blenny, yellow-tail, hog-choker, striped bass, white perch, sea-robin, spade-fish, snapper, black drum, pompano, file-fish, sea anemone, star-fish, lobster, shrimp, blue crab, hermit crab, king crab.

Fresh-water fishes: Rainbow trout, brook trout, steelhead trout, Scotch sea trout, quinnat salmon, landlocked salmon, Atlantic salmon, large-mouth black bass, small-mouth black bass, crappie, yellow perch, rock bass, common tench, golden tench, channel cat-fish, yellow cat-fish, golden ide, sun-fish, mill roach, chub sucker, common eel, paradise-fish, top-minnows, gold-fish, terrapin, snapping turtle.

The following table shows the maximum and minimum temperatures of the salt water from October 1 to June 30, and of the fresh water from July 1 to June 30:

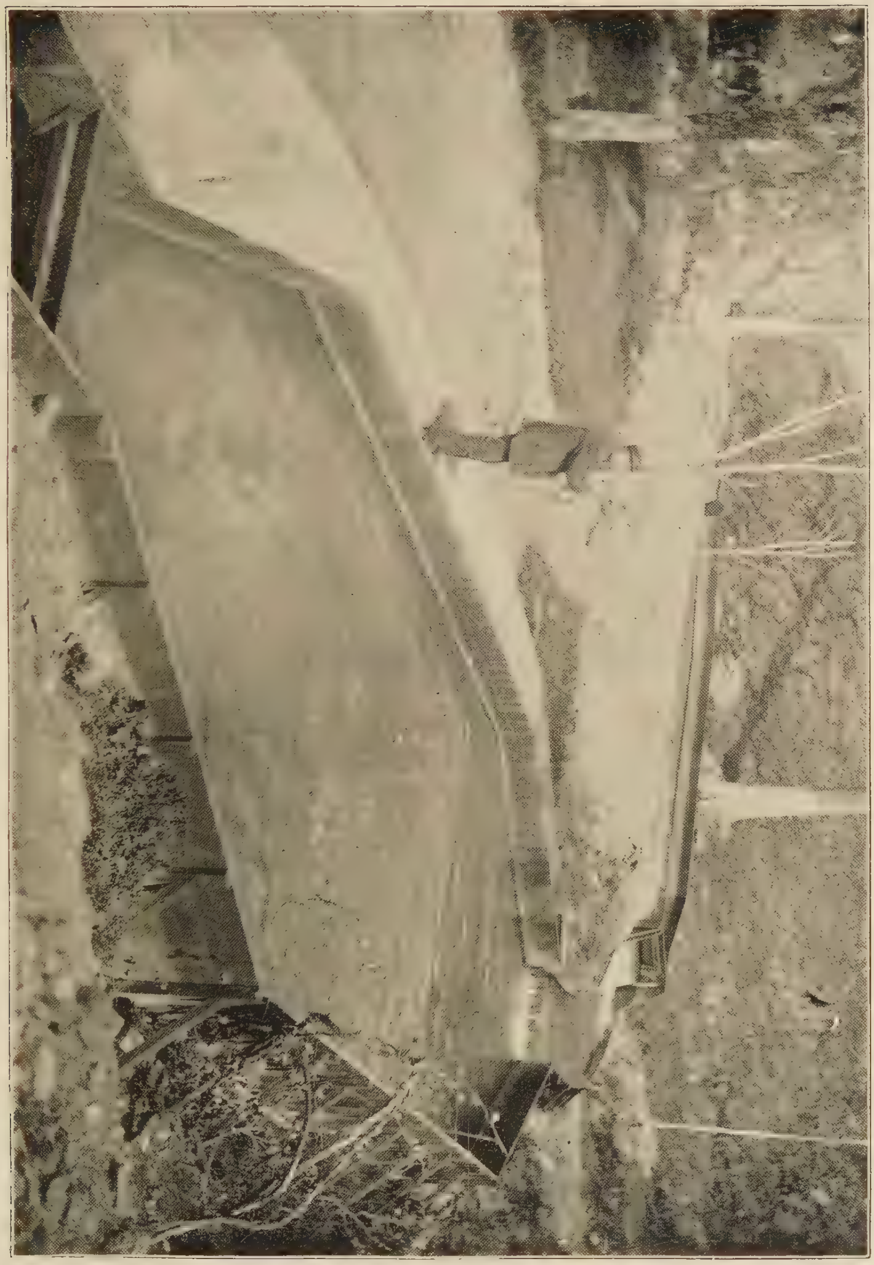
Month.	Fresh water.		Month.	Salt water.	
	Max.	Min.		Max.	Min.
	°F.	°F.		°F.	°F.
July	85	77	October	68	58
August	86	78	November	64	54
September	84	72	December	55	51
October	74	55	January	54	40
November	54	38	February	55	45
December	38	33	March	61	48
January	36	33	April	66	52
February	34	32	May	74	53
March	46	34	June	81	70
April	66	46			
May	71	64			
June	80	71			

WYTHEVILLE STATION, VIRGINIA (GEORGE A. SEAGLE, SUPERINTENDENT).

All of the fish hatched the previous spring having been disposed of, in order that the station might be thoroughly overhauled and remodeled, the employees were occupied during the summer in caring for the adult fish on hand and assisting in the general work of construction. In addition to rebuilding the old ponds 18 new ones were added, making a total of 42. The present system for trout comprises 8 stock-ponds and spawning-ponds 15 feet by 48 feet by 3⅓ feet, and 14 rearing-ponds varying in size from 10 feet by 50 feet to 15 feet by 106 feet, and from 6 inches to 5 feet in depth. For the basses and crappie 4 breeding-ponds and 15 rearing-ponds have been provided, and 1 pond for carp.

In constructing the trout ponds several minor improvements were made. In addition to providing the spawning-ponds with raceways 4 feet wide by 20 feet long by 1 foot deep, a receiver 2 feet by 4 feet by 2 feet was built at the foot of each pond between the guard-screens and the dam-boards, over which was set a grating in the space where the bottom was cut away. In this receiver excrement and other foul matter settles after passing from the pond through the guard-screen, and before washing over the dam-board into the raceway leading to the next pond below. This receiver is connected with a large sewer or waste-pipe of 8-inch terra cotta, which is closed at its mouth by a sliding gate arranged so that it can be drawn out to flush and clean the receiver and pond; by this means all foul matter is carried off through the flush-pipe without passing into the next pond.

PLATE XII.



WYTHEVILLE STATION, VIRGINIA—SPAWNING-POND, SHOWING RACEWAY.

The ponds were built with plank sides and earth bottoms, all timbers used in the construction being of the best white oak, thoroughly soaked in coal tar. In the lower corner of each pond was placed an outlet pipe constructed of heavy oak timber, in the form of a letter L, the short stem forming the standpipe in the corner of the pond. Around this was constructed a crib with guard-screens in front, and set in a receiving-trough at the bottom of the pond. The ponds along Tate Run are protected against the ravages of high water by piling and stone walls from 6 to 7 feet high, running parallel to the ends of the ponds. Between this protecting wall and the end wall of the pond is a space of 12 feet filled with earth, forming a strong embankment.

The trout ponds are located on the north side of Tate Run and are supplied with water from the spring. Those for the bass and crappie are on the south side and receive their supplies from Tate Run, the stream being tapped 1,580 feet above the ponds and the water conveyed through a 12-inch terra-cotta pipe laid with cement-mortared joints in a ditch from 3 to 6 feet below the surface and passing under the run about midway between the intake and the ponds.

A new residence was constructed for the superintendent, the former one having been condemned. This building was erected at a cost of $2,828.50, and is a two-story and cellar frame 56¾ by 53 feet It has a stone foundation and contains a parlor, sitting-room, kitchen, bathroom and bedroom on the first floor and 4 bedrooms on the second floor. It is heated by hot air.

The hatching capacity of the station was materially increased by a 10-foot addition to the east end of the hatchery, at an expense of about $547. Considerable was also done toward the improvement of the roadways on the Government property and in beautifying the grounds; maple trees were planted around the spawning-ponds to furnish necessary shade, and the old ice and storage sheds were removed. Additional funds are needed to put the station in first-class condition. The old nursery, which is essential for carrying fry during the early stages, is in bad condition and should be rebuilt.

The rainbow trout commenced spawning November 10 and the season continued until February 23, a period of 105 days. During this time 607,000 eggs were collected from 742 female fish, 425 males being used in fertilizing them. Of these eggs 465,000 proved good. As soon as they were eyed 230,000 were shipped to other hatcheries, State fish commissions, and foreign applicants and societies. The others were retained and hatched during March and April. There was practically no loss of fry during the first few weeks, but in May the fingerlings began to act strangely, darting and spinning around in the water in a dazed manner, and the daily death-rate increased from 40 to nearly 1,000. This state of affairs continued until June, when the disease disappeared, and on counting the fish it was found that 132,000 remained. These were carried to the close of the year without material loss.

On January 7 a consignment of 51,000 eyed brook-trout eggs was received from a private hatchery at South Wareham, Mass. These hatched within ten days after arrival, and the fry appeared to be strong and vigorous until about the 1st of April, when they began to deteriorate. Their gills became badly swollen and inflamed, and heavy losses occurred. This disease was thought to be due to the muddy condition of the water in April. By actual count on May 10 there were found to be only 11,800. The poor results were not unexpected, as several attempts have been made to rear brook trout at this station in past years without success, but as such fine results had been more recently attained in rearing rainbow trout, it was thought that good work might now be done with brook trout, especially as the water supply had been increased.

The brood-ponds for the black bass were prepared early in March, gravel supplied for building the nests, and the adult fish introduced on the 31st. On April 25 they began to show signs of nesting, and on May 10 the first eggs were observed. A number of other nests were noted on May 17, and all indications point to a good crop of young.

The rock bass were transferred to breeding-ponds on March 24, and nesting commenced late in April or early in May. Owing to the dense growth of water-plants it was impossible to remove the adult fish or to make any estimate as to the number of young hatched.

Of 85 three year-old crappie placed in the retaining-ponds during the year, only 12 remained when the pond was drawn in the spring. This loss was probably due to poachers, as no dead ones were seen in the pond during the winter. Those remaining were placed in a small breeding-pond provided with nests in March, but there is no indication that they have spawned, and as it is impossible to train crappie to take liver and food of like character, and as it is very difficult to obtain live food, it is doubtful whether it is advisable to continue experimenting with them.

Of the 1,350 quinnat salmon on hand at the beginning of the year, the result of eggs shipped to the station in the winter of 1897, 500 were released in Tate Run in February and 730 more on May 17, leaving 100 on hand. During the past year they have grown very little, though they consumed a large amount of food, and at the age of 2 years they were only from 7 to 9 inches in length. The 100 referred to will be retained at the station in order to note their growth, but will be placed in a larger pond than heretofore.

The propagation of carp for distribution was discontinued several years ago, but a number of the fish have been retained, with the view to rearing young ones as food for bass. These were placed in a pond 25 by 30 feet early in April, where they remained until June 8, without showing any signs of spawning. On that date they were transferred to two shallow narrow ponds, and on the following day deposited a large amount of spawn on the plants and moss growing in the ponds. As soon as the fry hatched they were transferred to the bass ponds as food for the young fish.

At the end of the year the stock of fish on hand was as follows:

Species.	Calendar year in which fish were hatched.					
	1899.	1898.	1897.	1896.	1895.	1894, or earlier.
Rainbow trout	128,360	3,008	2,972	511	647	512
Black bass (small-mouth)		26	21		5	
Black bass (large-mouth)			37	36	18	
Crappie			12			
Rock bass			32		80	
Quinnat salmon			100			
Carp					20	
Total	128,360	3,034	3,174	547	770	512

The fish food used during the year consisted of 8,957 pounds of beef liver, costing $441.29; 564 pounds of beef hearts, $27.79; 7,400 pounds wheat chop, $74; 364 1-pound cans herring roe, $14.56; 3 half-barrels salted herring roe, $3, making the total cost $560.64. To this must be added $119.26 for expressage, $163.50 for drayage, and $42.30 for ice, an aggregate of $885.70.

The trout fry were fed exclusively on fish roe until they were two months old, when they were given cooked liver and roe, alternately. At the end of the third month a mixed diet of raw liver and wheat chop was substituted. It is customary at this station to feed the fry six times a day until they learn to take food readily. When the liver and mush diet is taken up the number of daily feeds are reduced to four, and finally they are fed only three times, morning, noon, and evening. All trout over one year old are fed twice a day, on a mixture composed of four parts mush to one of liver. The amount given to each lot depends on the size and age of the fish, the smaller ones being allowed more in proportion to their weight than the larger ones.

From records kept during the year, it was found that 1,000 fingerlings, 4 months old and weighing 28½ ounces, consumed 4 ounces of food per day; 1,000 fish 18 to 24 months old, 7 to 9 inches in length and weighing 180 pounds, required 6¼ pounds daily; and a similar number of adults, from 12 to 16 inches long and weighing 1,040 pounds, took 25 pounds. It will be seen that the fingerlings 4 months old ate about 14 per cent of their weight daily, while adults required only 2½ per cent of theirs.

Erwin Station, Tennessee (S. G. Worth, in charge).

The superintendent and a part of the force were occupied the greater part of the year in the various works of construction authorized by the act of July 1, 1898, appropriating $4,418 for the completion of the station. The most important was the building of 30 rearing-ponds and 2 breeding-ponds below the hatchery, and the erection of an ice-house near the railroad crossing. General improvements to the roads and grounds were made.

In July there were 11,562 brook-trout fry and 73,099 rainbow-trout fry on hand. These were held through the summer in troughs in the hatchery and in rearing-ponds Nos. 1 to 6, and in September the distribution was made partly by means of car No. 1 and partly by the employees of the station, the output of rainbow trout amounting to 45,550 and of brook trout 6,000.

During October and November 1,000 adult fish were collected for brood stock from streams in the vicinity of Erwin and delivered at the station in good condition. The men employed for this work were paid 10 cents for each fish collected, and the hauling amounted to $30.75.

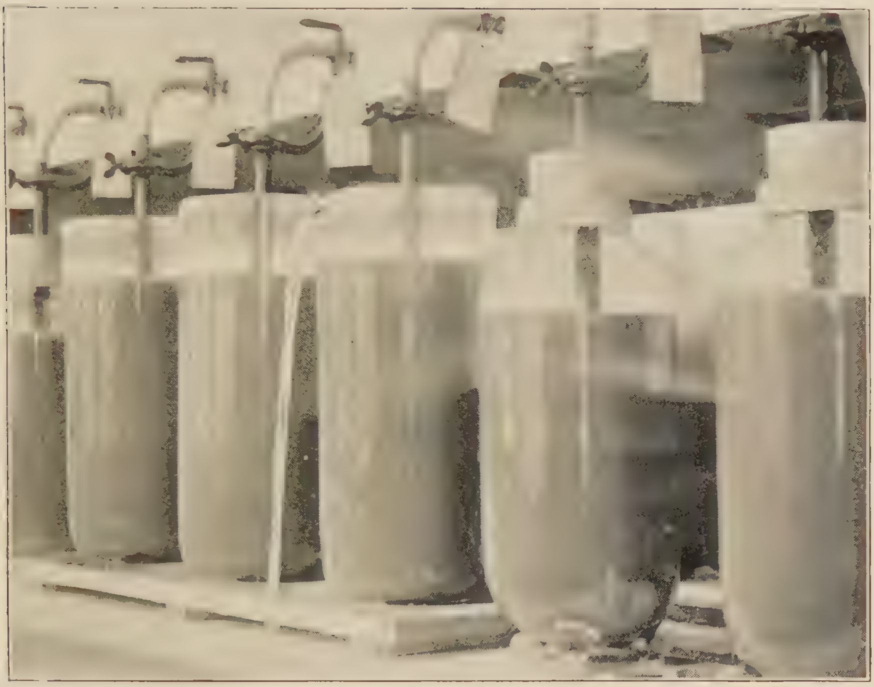
As most of the fish collected the previous year and held at the station had died during the summer, arrangements were made to purchase brook-trout eggs from private hatcheries in New England, three consignments, aggregating 253,109, being received from that source in January. The first and third shipments arrived safely, but the second lot were in bad condition, the temperature in the case when opened registering 56°.

The trout at the station commenced spawning October 19, and continued until November 19, yielding 106,500 eggs. The ponds in which they were confined had been provided with temporary raceways, but they failed to ascend them, and it became necessary to capture the greater number with seines. 94,766 of the eggs died and only 11,734 fry were hatched. The eggs from Massachusetts yielded 243,901 fry. The losses during the winter on fry hatched from eggs collected at the station were very heavy, and by March 1 only 1,000 remained. Of those purchased, 221,760 were on hand on that date.

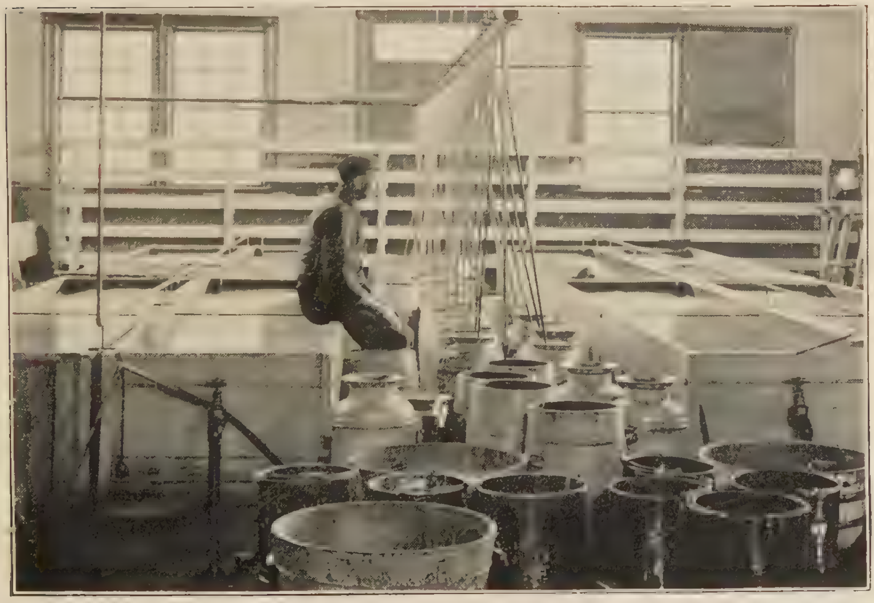
In January two consignments of rainbow-trout eggs, aggregating 75,000, were received from Wytheville. These commenced hatching January 30, and yielded 72,208 fry, 68,040 of which survived to March 1. This number also covers 900 fry hatched from a small lot of eggs derived from rainbow-trout reared at this station.

On March 23 the work of transferring the fry of both brook and rainbow trout from the hatching-troughs to the six ponds northeast of the hatchery was commenced, and as soon as the new ponds below the hatchery were completed they were also used for this purpose, the fish being first assorted and counted and about 5,000 placed to each pond. The death-rate after the fry were transferred to the ponds continued high—the loss in April of the brook trout amounting to 14,293, and of the rainbows 3,078. In May the mortality of the brook trout amounted to 4,096, and of the rainbows 848. In June 9,534 brook trout died, and 961 rainbows, leaving on hand at the close of the year 48,545 rainbow-trout fry and 76,588 brook-trout fry.

Several experiments were tried in June to ascertain, if possible, the cause of the excessive mortality in the new ponds. A fence 3 feet high, of domestic cloth, was placed around one where the mortality was heavy; boards were put on edge around the banks of another to prevent the young fish from sleeping in the shallow water; bulkheads



NEW AND OLD HATCHING-JARS IN USE AT PUT-IN BAY STATION



PUT-IN BAY STATION—SHOWING ARRANGEMENTS FOR PIKE-PERCH EGGS BEFORE THEY ARE PLACED IN HATCHING-JARS.

were put in several—some at the head of the pond in order to prevent the fry from injuring themselves by leaping. Shade was also provided, traps of various kinds were placed for the purpose of catching rats and other animals destructive to fish, and a night watch was established. In some of the ponds the fish were thoroughly assorted and in other ponds wood mold was used liberally, several bushels being thrown in the water at a time. These experiments failed to produce any beneficial results, and it was finally concluded that the large loss was due to the ravages of the belostoma. This insect appeared in comparatively large numbers about June 15, as many as 12 specimens being caught on one day, June 28. Before it made its appearance around the upper ponds the death rate there was light, but with its increase the mortality was greater. This bug, well known as one of the most destructive enemies of young fish, does its work at night. It both flies and crawls, and it apparently came into the ponds through the open ditch.

At the close of the year there remained on hand the following fish:

Species.	Calendar year in which fish were hatched.				
	1899.	1898.	1897.	Adults collected in 1898.	Adults collected in 1897.
Brook trout	76, 588	991		482	384
Rainbow trout	48, 545	2, 975	764		
Total	125. 133	3, 966	764	482	384

PUT-IN BAY STATION, OHIO (J. J. STRANAHAN, SUPERINTENDENT).

The weather during the white-fish season was worse than any experienced for a decade, as shown by the marine reports, in which it is recorded that the loss of vessels on the Great Lakes was the largest in the history of the country. In addition to this, the season opened later than usual, the first eggs being secured on November 11. On the 23d the mercury dropped to 19°, and fishing practically ceased at the very height of the season, the fishermen removing their nets to prevent their being caught in the ice and destroyed. Notwithstanding these unfavorable conditions, the catch at the west end of the lake was greater than for several years previous; 83,403,000 eggs were secured from the boats of the commercial fishermen and 12,785 adult fish were penned at Put-in Bay Island and Monroe Piers, Michigan, from which 102,051,000 eggs were taken, making a total of 185,454,000 for the season, as against 112,842,000 the previous year. The work of penning live fish began at both points on October 31, and continued uninterruptedly, except on very stormy days, until November 21 at Monroe Piers and November 29 at the station.

The fish at Monroe Piers were evidently more advanced than those at Put-in Bay, the first eggs there being secured on November 11, whereas at the station no eggs were obtained until December 17.

As the work of penning white-fish had been conducted on a very limited scale the previous year, it was necessary this season to construct five new rafts, which, with the old one, gave a capacity for from 15,000 to 18,000 fish. These rafts carry five crates each, each crate being divided into two pens 8 feet square and 6¼ feet deep. The boom logs at the sides of the rafts were discarded, as they were clumsy and did not afford sufficient space for walks. Gunwales were made of 4 by 8 inch hemlock joists, placed 2 feet apart and trussed at frequent intervals by diagonal cross-ties and braces, on top of which were placed two tiers of 2-foot-wide hemlock planks, making the gunwale, as built up, 52 feet long, 2 feet wide, and 1 foot deep, strong and rigid, and able to withstand seas of considerable violence. At each end and between all the crates were 2-foot plank walks, giving ample room for working on all sides, a consideration of the utmost importance in handling fish and fertilizing eggs in stormy weather. With these improvements the rafts are considered almost perfect for the work.

A large live-car, capable of holding 600 fish, was also constructed at Monroe Piers, to be used in conveying fish from the nets to the crates. This did not prove as effective or convenient, however, as tanks carried on the decks of the steamers.

The work at Monroe was under direction of J. C. Fox, foreman of Put-in Bay station, who reported that of 8,779 fish placed in subnets, 8,624 were transferred to the crates, about half of them being females; 3,307 of these yielded 62,208,000 eggs, an average of 18,961. At the close of the season 8,584 fish were returned to the fishermen, only 195 having been lost.

At Put-in Bay 4,282 fish were collected, of which 1,217 yielded 39,843,000 eggs, an average of 32,738 per fish. Of the whole number collected, 3,921 were returned to the fishermen, 237 died or were liberated, and 3 were held at the station for experimental purposes.

Comparing the cost of operating at these two points with that of collecting from the boats of the commercial fishermen, it was found that the cost per quart of those secured from the fishermen was 72.56 cents, those from fish penned at Put-in Bay cost 76.22 cents, and from the Monroe crates 77.53 cents, the average cost of the crated fish being 76.87 cents per quart. With an ordinarily good season the 6,125 females should have furnished 171,500,000 eggs, on a basis of 35,000 per fish, estimating four-fifths of them as productive.

Of the eggs collected, 126,036,000 were held at the station to be hatched and planted in Lake Erie, 32,508,000 were shipped to Alpena, 12,132,000 to Duluth, and 14,778,000 to Cape Vincent. The number of fry hatched was 105,500,000. These were planted with comparatively small losses on the spawning-grounds in Lake Erie, reefs and gravel bars where white-fish deposit their eggs naturally being selected.

The fry were planted under favorable conditions, the water being clear, and immense numbers of Daphnia, Cyclops, Diaptomus, and other crustacea being observed.

A few white-fish fry were kept in a floating box in one of the fry tanks, and in the same tank outside the floating box about 1,000 pike-perch fry were retained. Both of these lots throve on food found in the water. The superintendent's attention was called by Mr. E. M. Ball to the fact that the white-fish fry avoided the Diaptomus, which is easily distinguished by its long antennæ. He then began a series of observations with both white-fish and pike-perch fry, and found that Mr. Ball's conclusions were correct. The fry partook freely of the other forms of life, but refused to touch the Diaptomus. It was also observed that by the end of the third or fourth day all forms of life became scarce except this.

As the success of the white-fish work depends to a large extent upon the abundance of natural food when the fry are first planted, and as this food seems to be present only when the water is clear, it seems advisable, in making future plants, to pay more attention to the condition of the water in which deposits are made. In other words, if the water in one locality is clear the fry should be planted there, even though it may not be the natural spawning-ground of the fish.

Further experiments were conducted at the station this season to determine how long eggs may be held in water before applying the milt and still retain their vitality. As a result of these observations, it was ascertained that 97 per cent could be fertilized after being in the water six minutes, 98½ per cent being fertilized where the milt was applied instantly. At the end of the eighth minute only 81 per cent were impregnated; at the expiration of the tenth minute, 47½ per cent; at the fifteenth minute, 40½ per cent; at the twenty-fifth minute, 17 per cent. After sixty minutes not an egg was fertilized. The object in making these experiments was to find out how long the eggs may be held in water and still be capable of perfect fertilization, in order to determine how wide a range may be depended on in remilting.

Experiments with pike perch eggs during the past season seem to indicate that the eggs of this fish may be remilted to great advantage; but unfortunately the experiments could not be continued this year.

A number of experiments were also tried to determine whether or not it is advisable to remilt all eggs. From the first lot 16½ per cent of unimpregnated eggs were found where the milt was applied only once and 12.2 per cent where applied twice. In the second lot fertilization was the same by both methods. In the third lot there was a difference of less than 0.4 per cent.

As it is impossible to use the dry method of fertilization in very rough weather or when raining very hard, some experiments were tried to determine the difference in results between the wet and dry methods. In the first two experiments the wet process produced slightly better results; in the last, the dry.

The season for pike perch was peculiar in many respects. It opened ten days late, as the ice remained in the lake much longer than usual; but fishing ceased about the usual time, and the rapid rise in temperature prevented good work, though large numbers of eggs were secured. Arrangements had been made to pen pike perch as an experiment at Monroe Piers and Put in Bay, but the operations were not as successful as had been anticipated. Contrary to expectation, the fish did not stand transportation or confinement as well as the white-fish, though apparently they are more hardy; but this may have been due to the higher temperature of the water at the time of the collection and penning of these fish. It was also found impossible to carry as many of these fish in the tanks on the steamer, due probably to the warmer water. From this season's work it appears that pike perch will not yield good eggs after being held in confinement more than three days, and that the males can not be used more than once.

The percentage of fertilization from the fish confined in the pens at Monroe Piers was exceedingly small. During the season 2,771 were penned, of which 1,486 were females. After the eggs had been stripped 2,638 were returned to the fishermen, the remaining 133 having died in the pens. The 956 females stripped yielded 84,675,000 eggs, an average of 88,572 per fish.

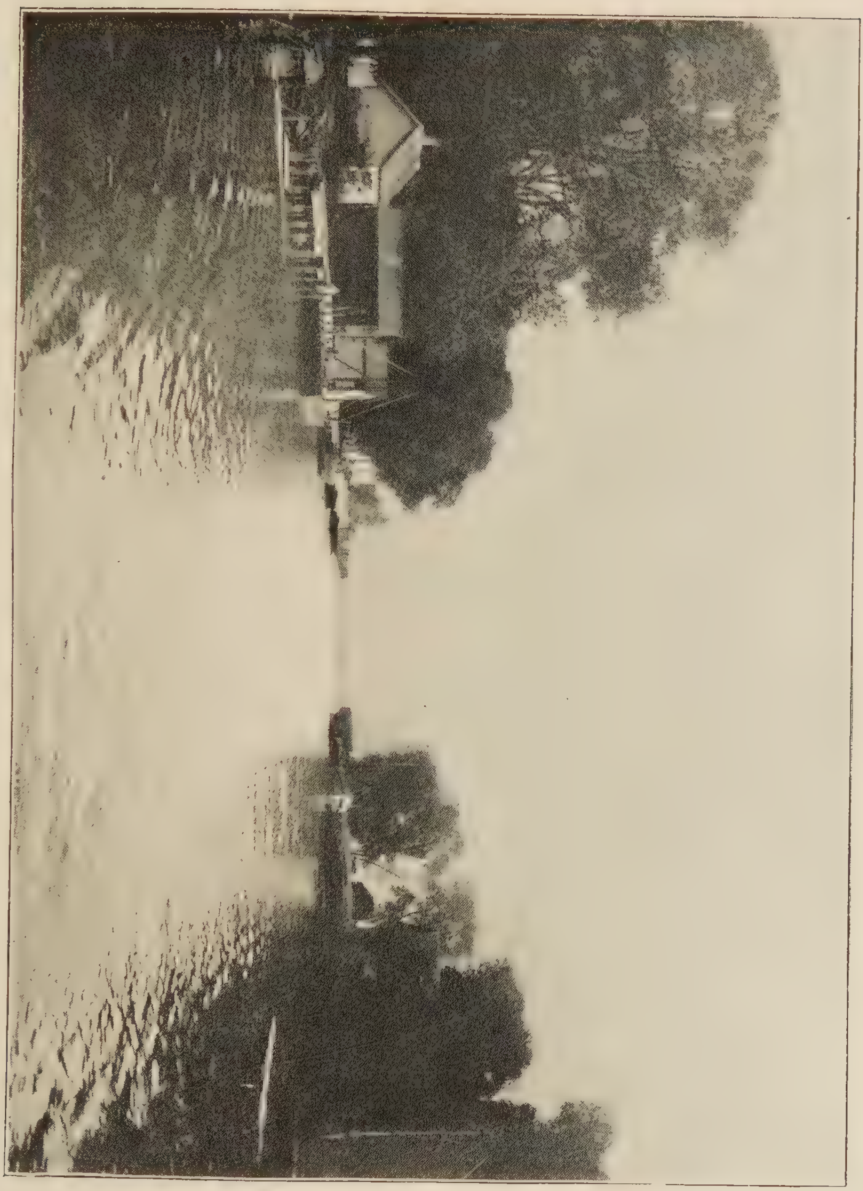
The temperature of the water at Monroe Piers averaged 55½° during the 15 days collections were made; but it varied greatly, frequently changing 5° to 6° in a half hour, according as the wind or tide set in or out at the mouth of the river. Its maximum was 60°.

At Put-in Bay 252 fish were penned, 111 of them being females. These yielded 3,187,700 eggs, an average of 72,447 per fish.

As soon as the eggs are received at the station they are placed in 5-gallon kegs for about 24 hours and a gentle stream of water is allowed to flow over them. At the expiration of that time they are placed in jars, 3½ quarts to each jar. At the end of three days they will have swelled to a bulk of about 4½ quarts. To attain the best results the eggs should be worked with the least amount of water possible to keep them in motion. This is very important, as experience shows that two jars of equally good eggs will produce very different results if one is worked rapidly and the other slowly.

Of the 493,000,000 eggs collected, 65,630,000 were transferred to the Alpena and Cape Vincent stations. The others were hatched at the station and planted on the spawning-grounds in the vicinity of Put-in Bay, Port Clinton, Monroe Piers, and Toledo. They commenced hatching on May 4 and by May 17 plants amounting to 198,540,000 had been made, all in Lake Erie with the exception of a few million used for stocking lakes in Indiana.

Toward the close of the season the fry were sent out in a 400-gallon tank on the steamer *Shearwater*, instead of in cans or kegs in the usual manner. This very much simplified the work of planting, as the fry were drawn from the tanks in the hatchery by means of a 1-inch rubber hose acting as a siphon to the tank on the vessel. In this way the vessel was loaded in about fifteen minutes, whereas it requires from two to three hours to do the work in the ordinary way. Careful



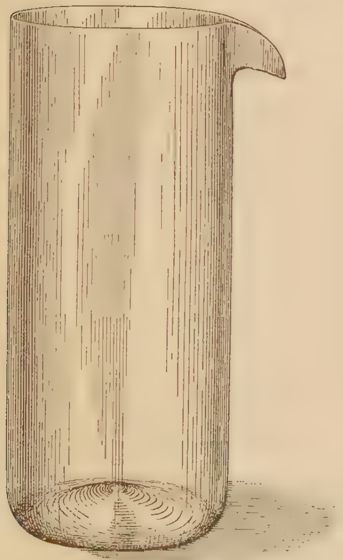
HARBOR AT MONROE PIERS, MICH.—U. S. FISH COMMISSION BUILDING SECOND ON THE LEFT.

examination showed that the fry were not injured by being passed through the pipe. When the vessel arrived on the planting grounds a section of hose about 10 feet long was attached to the bottom of the tank and the fry were allowed to pass overboard through it. By placing the end of the hose under the surface of the water no possible injury could result.

The following gives the temperature of air and water at the station during the year:

Month.	Air.			Water.			Month.	Air.			Water.		
	Max.	Min.	Mean.	Max.	Min.	Mean.		Max.	Min.	Mean.	Max.	Min.	Mean.
1898.	°F.	°F.	°F.	°F.	°F.	°F.	1899.	°F.	°F.	°F.	°F.	°F.	°F
July	92	62	77	84	70	76	Jan	49	—0	26.75	32.5	32.5	32.5
Aug	88	70	76	79	73	76.2	Feb	53	—11	21.79	32.5	32.5	32.5
Sept	90	56	69.3	77.5	65	69.83	Mar	50	18	32.61	35	32.5	33.59
Oct	76	34	51	74	47	58.6	Apr	85	27	49.53	58	33	42.27
Nov	62	19	39.76	50	37	43.13	May	81	52	62.41	65	54	58.82
Dec	45	6	28.85	36	32.5	33.22	June	90	60	73.23	75	62	68.7

On March 12 a field of ice gorged at the point where the west intake pipe enters the lake and carried away 20 feet of the 10-inch suction pipe. On May 30 the storehouse of the station and its contents were burned. Spontaneous combustion is supposed to have been the cause of the fire. The loss amounted to about $438.



White-fish hatching jar designed by J. J. Stranahan.

Experiments have been conducted for a number of years with the purpose of designing a jar better adapted for the white-fish and pike-perch work than the McDonald jar. One designed by the superintendent and manufactured by Dorflinger & Sons, of White Mills, Pa., was used this season along with the old jars, and from the results attained it is believed it will be an improvement over the old form. It is of glass, 15½ inches high and 7 inches in diameter, with a glass spout, thus eliminating the old metal spout, which had to be attached to the jar by rubber gaskets, putty, or cement. The bottom is 5 inches in diameter and rests directly on the shelf, obviating the necessity for glass legs, which are apt to break. It works well with 5 quarts of eggs, using less water than the McDonald jar, and by filling the jar to within an inch of the top it acts automatically, all fungused eggs being carried over into the receiving-trough by the current of water. They are prevented from entering the lower row of jars by wire-cloth pockets inserted in the outlet of the discharge trough. The water enters the jar through a steel tube with a trumpet-shaped bottom, the internal diameter of which is greater than the external diameter of the rubber tube which attaches it to the supply tank. The advantage of this arrangement is that it permits the escape of the air upward.

Experiments were carried on in order to determine definitely the most effective means of preventing the adhesion of eggs while being fertilized. It was learned that adhesion may be absolutely prevented by applying just enough water to fill and slightly cover the egg mass, then adding (every 10 minutes for the first hour and every 20 minutes for the second) additional water to cover the eggs, stirring gently each time. This operation requires two or three hours' time, but it is strongly recommended where eggs are taken in small quantities. A number of jars manipulated in this way hatched over 85 per cent, the best percentage during the season.

The use of swamp muck was continued, and after careful experimenting it was decided that it is better to use the muck in the pan after fertilization takes place than to introduce it in the kegs in which the eggs are poured after being fertilized. The eggs should be allowed to stand in the milt and sufficient water to cover them for about 10 minutes, when a tablespoonful of the muck mixture, about the consistency of cream, should be added. This gives the egg mass a dark-gray color. Water should then be added until the pan is nearly full, the mass being stirred gently and then allowed to stand a half hour. The important point in preventing adhesion is to let the eggs stand until the particles of muck have settled, then pour off the comparatively clear water, adding a fresh supply and gently agitating the eggs. Most of the muck particles will have settled at the end of a minute, the water becoming clear.

The preparation of the swamp-muck solution is simple, but should be carefully conducted. The plan pursued at Put-in Bay is as follows: The apparatus consists of two tubs and a screen about 20 by 30 inches, made of fine brass wire cloth—about 40 strands to the inch. After selecting a suitable location a depression is dug in the muck, which quickly fills with water. The muck is dissolved in this by constant beating and stirring, care being exercised not to get the mixture too thick, as in that event the sand will not settle. This is then poured through the screen into the tubs. When the water has partially cleared in the tubs it is poured off, leaving a few quarts of the muck of the consistency of thick cream in the bottom. The tubs are again filled with water, thoroughly agitated, and allowed to stand a few seconds so that the sand may settle. The water containing the solution is then poured in kegs or cans, where it remains for an hour or more, when the water is drained off, leaving the muck in the bottom. It should be free from sand, which interferes with the working of the eggs in the jars. The muck must now be thoroughly scalded in order to prevent the development of infusoria, which at times are apt to cause much trouble. The preparation may be dried in any desired form and held ready for use.

NORTHVILLE STATION, MICHIGAN (FRANK N. CLARK, SUPERINTENDENT).

During the summer the station force was occupied in painting the buildings, improving the lawns, and getting the hatching and collecting apparatus ready for the fall work. In August the superintendent, accompanied by Mr. H. H. Marks, who was employed to act as field foreman during the absence of Mr. S. W. Downing on the Pacific coast, visited the important fishing centers on Lakes Huron, Michigan, and Superior, to arrange for the collection of lake-trout eggs. As results on Lake Superior the previous year had been poor, arrangements were made for operating there only in the vicinity of Sault Ste. Marie.

Particular attention was paid to the fishing-grounds on Georgian Bay and the upper end of Lake Michigan, including Beaver Island, and spawn-takers were stationed at Pilot Harbor, Cockburn Island, Meldrum Bay, Burnt, Green, and Duck islands. The first eggs were collected on October 13, but the fish were driven out into deep water about this time by a heavy storm, and unprecedentedly bad weather prevailed to the close of the fishing season, preventing the fishermen from lifting their nets oftener than once or twice a week (most of the fish being then either spent or dead), and also causing considerable loss on the fishing tugs. The spawn-takers were shifted from field to field, as weather conditions demanded, and every effort was made to fill the hatchery before November 3, the commencement of the close season. On October 20 three cases of eggs were received from Lake Superior, but the temperature at the time of shipment was so high that they came through in poor condition. The operations resulted in the delivery of 3,978,000 eggs at Northville, the last shipment arriving November 7. On the first of the month the indications were that the trout had just commenced to spawn in large numbers, and if operations could have been continued for ten or twelve days, there is little doubt that large collections could have been made, particularly at Beaver Island.

The eggs were placed in troughs at the station and commenced hatching December 4. The distribution of the fry was made from January 19 to March 14, 2,800,000 being deposited on spawning-grounds in lakes Huron and Michigan, and 60,000 furnished for inland lakes in Michigan and Indiana. The remaining 200,000 were put in troughs, to be held until fall. At the close of the year there were estimated to be about 130,000 on hand. These were about 3 inches long and were doing well.

The fingerlings on hand at the beginning of the year (hatched in January, 1898) were held through the summer and planted during August and September without loss in Lakes Superior, Michigan, and Huron.

The passage of an act, known as the Milliken bill, by the Michigan legislature, authorizing the United States Fish Commission to fish in any of the waters of the State at any season of the year for the purpose of gathering spawn from the fish so caught, with the provision that such work be under the supervision and control of the State game and fish warden and that 75 per cent of the fry resulting from spawn so taken be planted in the waters of Michigan, will allow the Commission in future to continue work during the closed season, and will undoubtedly permit the collection of as many lake-trout eggs as may be needed to fill the hatcheries of the Commission.

The brook-trout brood-fish at the station yielded 97,600 eggs between October 18 and December 13. As it is important that the supply of this fish be kept up in the various streams of Michigan, 638,000 eggs were purchased from a private hatchery at South Wareham, Mass., and 96,000 eggs from wild fish were transferred from the St. Johnsbury station. The eggs from Vermont were excellent, and commenced hatching December 10 and finished December 22, producing 94,114 strong, active fry. Of these, 92,994 remained in the rearing-troughs February 8. Early in April these fry were observed to be peculiarly affected. They refused to take food, seemed to grow constantly weaker, and each of the affected ones developed a small red spot. By May 1 they commenced dying in large numbers, and before the disease could be checked and the fish distributed nearly 32,000 had died.

New hatchery, Northville Station, 1899.

The eggs purchased from Massachusetts produced 618,000 fry, which were held for several months and then distributed, making the total distribution of brook-trout fingerlings 669,000. A small number were retained for the fall distribution, and on June 30 they numbered 31,493.

During November the trout carried over from the previous year were attacked by an epidemic, and very heavy losses ensued. Mr. M. C.

Marsh was detailed from November 14 to 27 to investigate the disease, and on his return to Washington, Dr. C. M. Blackford was sent to continue the investigation, remaining in Northville from December 5 to January 14. The affection was apparently traced to bacteria, supposed to have been caused by the rotting timbers of which the ponds were constructed. From experiments conducted at the station it would appear that even where an epidemic of this character prevails, if the fish can be transferred to open waters and allowed to subsist on natural food the mortality will at once cease. On June 9, 5,000 brook-trout fry, which had been fed for several months in the rearing-troughs and were from 2½ to 3 inches long, were placed in the spring pond, where they received only the natural food contained in the spring water. After remaining there for some time they began to assume a different color from those fed on liver, their tails and fins becoming very brilliant and presenting a beautiful appearance. Not over half a dozen dead ones were taken from the spring from the time they were introduced to September 30, yet when counted on that date there were only 3,400, the loss being attributed to kingfishers and destructive animals.

The Loch Leven brood trout were quite old and yielded only 14,500 eggs, all of which were shipped to Prof. William A. Locy, of the Northwestern University, Evanston, Ill., and to the Connecticut Fish and Game Commission. On June 30 there were 107 Loch Leven trout of the hatch of 1895, 1,464 of 1897, and 2,308 of 1898. The fish of 1897 will probably yield a considerable number of eggs during the coming fall.

Of the steelhead trout on hand at the beginning of the year, 2,500 were planted in September in streams along the line of the Flint and Pere Marquette Railroad. At the close of the year there remained on hand 607 of the hatch of 1897 and 3,549 of the hatch of 1898. A case of eggs was received from Oregon in June, but unusually warm weather en route caused almost a total loss. The 5,000 fry hatched from them were doing well at the close of the year.

On February 2, 16,500 rainbow-trout eggs were received from Neosho; these yielded 13,000 fry, which were distributed during the spring.

On the 6th of June 67,360 grayling eggs were received from Elk Creek, Montana. Though the weather was very warm, the condition of the eggs on arrival was excellent, the temperature of the top tray being 55° and the middle of the case 60°. They were hatched on open trays in shallow troughs. A few of the fry came out immediately after being unpacked, and by June 13 they were all hatched, but it was noted that the fry remained at the bottom of the trough for several days before attempting to swim. The fry from Michigan grayling, handled at Northville fifteen years ago, commenced to swim as soon as hatched, and were much larger and stronger than these. Of the 55,000 resulting from the shipment, 50,000 were planted in the Au Sable and Pere Marquette rivers. The balance were retained for observation and experiment, and at the close of the year they were doing well, apparently taking food as freely as the trout.

ALPENA STATION, MICHIGAN (F. N. CLARK, SUPERINTENDENT).

This station was closed from July 1 to November 24, on which date 36,120,000 white-fish eggs arrived from the auxiliary station at Monroe Piers, Mich.; 500,000 of these were shipped, as soon as the eye-spots appeared, to New Zealand, for the New Zealand Fish Commission. The eggs seemed to develop normally at first, but about the middle of December Mr. Downing reported them to be in poor condition. A consignment of 30,000 was sent to Northville, and Dr. Blackford, who was engaged there in studying the diseases of the brook trout, made a thorough examination of them, pronouncing them to be in good condition. They were placed in spring water, where they developed very rapidly, half of them hatching by January 27. The eggs at Alpena commenced hatching on April 13 and finished on the 28th, yielding 28,000,000 fry, about 79 per cent of the total number of eggs received. These were deposited in Lakes Michigan, Huron, and Superior, and some inland lakes at Iron Mountain, Mich.

U. S. Fish Commission building, Monroe Piers, Michigan.

Arrangements were made during the fall to collect pike-perch eggs in Saginaw Bay, and on the 17th of April the foreman, Mr. Downing, began operations, shipping the first eggs to Alpena on April 20. The results at this point were only fair, owing principally to the fact that the ice remained in the lake so much later than usual that the earlier spawners, which produce the best eggs, had already deposited their eggs. Collections continued until May 3, but the eggs secured were of poor quality. On April 22 and 25 two shipments of eggs, aggregating 41,630,000, were received from the Put-in-Bay auxiliary station at Monroe Piers. They yielded only about 30 per cent of fry, which hatched between May 12 and 18. The Michigan Commission received 12,000,000 of them for distribution in inland lakes in Lenawee, Cass, St. Joseph, Calhoun, Barry, Jackson, Ingham, Cheboygan, Emmet, Antrim, and Wexford counties, Mich. The remainder were planted as follows: 7,500,000 in Saginaw Bay, 4,000,000 in Thunder Bay, 1,000,000 in Hamlin Lake, near Ludington, and 500,000 in Devils Lake, near Addison, Mich. From the experience gained this spring it is believed that with fairly good weather very large collections of pike-perch eggs might be made in Saginaw Bay.

Duluth Station, Minnesota (S. P. Wires, Superintendent).

During August arrangements were made for collecting lake-trout and white-fish eggs at a number of points in Minnesota and Ontario, also at Isle Royale and Ontonagon, Mich.

The lake trout commenced to spawn about the middle of September in the vicinity of Rossport and Port Arthur, and along the Michigan shores about the 20th. Eggs continued to come in until November 4, the total collections aggregating 6,300,000; 1,950,000 of these were obtained from the Isle Royale field, 315,000 from Grand Portage, Minn., 2,300,000 from Rossport, 1,235,000 from Ontonagon and vicinity, and 500,000 from Copper Harbor, Mich. Shipments amounting to 875,000 were made to other stations of the Commission, State fish commissions, and private applicants, and 1,500 were sent to Chicago University for biological purposes. The eggs retained at the station were carried through the winter without unusual loss and commenced hatching late in April. The distribution was started as soon as the yolk-sac was absorbed—about May 10—and lasted until June 30, the entire output amounting to 4,335,000 fry, which were planted in the vicinity of the spawning-grounds from which the eggs were secured.

In addition to the 7,067,000 white-fish eggs collected in the vicinity of Port Arthur, Ontario, 12,132,000 were transferred to the station from Put-in Bay. From this stock 15,300,000 fry were hatched and planted during the month of May in Lake Superior.

In February, 100,000 brook trout eggs were received from Leadville, and in May and June 100,000 grayling eggs from Bozeman, and 93,000 steelhead eggs from Clackamas. The brook-trout eggs were in excellent condition, and hatched 87,308 fry, which were distributed in public and private waters during the summer. The steelheads were shipped in three consignments, the first of which reached the station in fair condition, but only about 50 per cent of the others were saved. At the close of the year 53,841 of these fish remained. On the grayling eggs, received in two consignments, on June 26 and 27, there was a loss of 15,000 in transit. The eggs were so far advanced on their arrival that they commenced hatching as soon as placed on the trays, the water temperature at the time registering 60°. Owing to this high temperature and to the poor condition of the eggs when received, only about 15,000 healthy fry remained at the close of the year.

In planting the fry hatched at this station, steamers are utilized for conveying them to the natural spawning-grounds. The fish are carried in 10-gallon cans, 30,000 to the can, the water being kept at from 35° to 44°, and fresh supplies substituted when necessary. When the vessel approaches the planting-grounds, the fry are poured into a tub filled with water and placed in the gangway. Into the side of this tub is fitted a spout 2½ inches in diameter and long enough so that when the tub is in position it extends about 6 feet out from the steamer, its end touching the surface of the water. The fry pass through this spout, and as the steamer is running from 6 to 10 miles per hour while the deposit is being made, a plant of 240,000 is scattered over several miles of territory.

During the year a number of improvements were made. A new two-story frame building 18 by 22 feet was erected south of the hatchery. Upon the first floor, which will be used as a supplementary hatchery, 8 hatching-troughs, 4 large fry-troughs, and a picking-trough were arranged. The upper story will be utilized as a workshop and storehouse. The crib wall on the beach south of the hatching-house was raised, and the carpenter shop, which stood on the bank of the river, was moved and set up over it. The small octagonal building located over the reservoir was removed to a point just east of the out-of-door fry-troughs, and is now used for storing paints and oils. A pier 8 feet by 24 feet by 3½ feet was built and filled with rock near the mouth of the Lester River to protect the end of the drain pipe running from the hatchery from becoming covered with gravel or being broken off by the waves from the lake. A new gravel road was also constructed from Lester street across the hatchery grounds to a point near the flagstaff, thence north to a junction with Park avenue. A number of other walks were laid out, improving the grounds greatly, and a large amount of grading was done north of the hatching-house. During the summer all of the hatching apparatus was overhauled and painted.

QUINCY STATION, ILLINOIS (S. P. BARTLETT, SUPERINTENDENT).

As indicated in the report for the previous year, the spring of 1898 was unusually favorable for the spawning of bass and crappie in the overflowed regions of the Illinois and Mississippi river valleys; consequently young bass were very plentiful at the beginning of the fiscal year. The spring having been warm and the temperature of the water high, the young fish grew very rapidly, and it was an ordinary occurrence during the summer to take specimens weighing ¾ pound from schools hatched late in the spring. The early part of July was marked by heavy storms extending the whole length of the river and causing high water, nevertheless 30,000 large-mouthed bass were collected that month and 24,000 shipped. Had there been sufficient storage room it would have been possible to have secured 100,000 during the same period. The fish averaged 4 inches in length.

On August 3, immediately after a severe storm, accompanied by electrical disturbances, 2,400 of the largest bass were found dead in one of the ponds. As the fish in the other ponds were not affected it was thought this pond was struck by lightning. Other storms occurring in August interfered with the work very materially, but operations continued to the middle of November, the season's work resulting in the collection and distribution of 68,452 black bass, 9,270 crappie, and 1,250 cat-fish. In addition, large numbers of the coarser fishes were taken from ponds that were drying up and transferred to living waters.

Crappie were very plentiful early in the season, but on account of the great difficulty experienced in transporting these fish prior to the middle of September no effort was made to collect them until fall.

Through the courtesy of the Illinois Fish Commission the steamer *Lotus* was available for making collections during part of the season, and rendered valuable assistance.

MANCHESTER STATION, IOWA (R. S. JOHNSON, SUPERINTENDENT).

During the summer and fall of 1898, pending the obtainment of a special appropriation for the completion of the station, considerable work was done on ponds X, Y, and Z, so that they would be available for fish-cultural purposes the following season. A breeding-pond for crappie, 80 by 40 feet, with an average depth of 2 feet, was excavated and lined with plank. During the winter an appropriation of $6,000 was secured for the completion of the station, including the construction of additional breeding-ponds and the protection of the ponds and grounds from freshets in Spring Branch, and work was commenced on April 17.

By the end of the year steam-heating plants had been installed in the hatchery and residence and a contract was given out for the building of a stone protection wall from the upper spring reservoir along Spring Branch; 3 spawning-ponds, 75 by 17 feet, and 3 feet deep, had been completed; also 6 rearing-ponds, 22 by 7 feet, and 3 feet deep. The 80-foot ponds previously constructed, which had been lined with cobblestones laid in clay, became so unsatisfactory that the stones were removed and four were lined with concrete and cement and the other four with 2-inch hemlock plank. A breeding-pond for bass, 150 by 100 feet, and 4 feet deep, was excavated and its sides lined with plank. As the soil is too porous to hold water the bottom will be lined with clay to the depth of 4 inches. The channel in Lower Spring Branch was straightened and widened and a stone wall was built to protect pond X from freshets. A protection wall of cement and stone, 5 feet high and 3½ feet thick, was constructed from the wagon-bridge along Spring Branch to a point opposite the dwelling, and the channel of the branch was moved 75 feet westward. All of the low land east of the protection wall was filled in and graded, and the work of constructing a dam across Spring Branch was commenced.

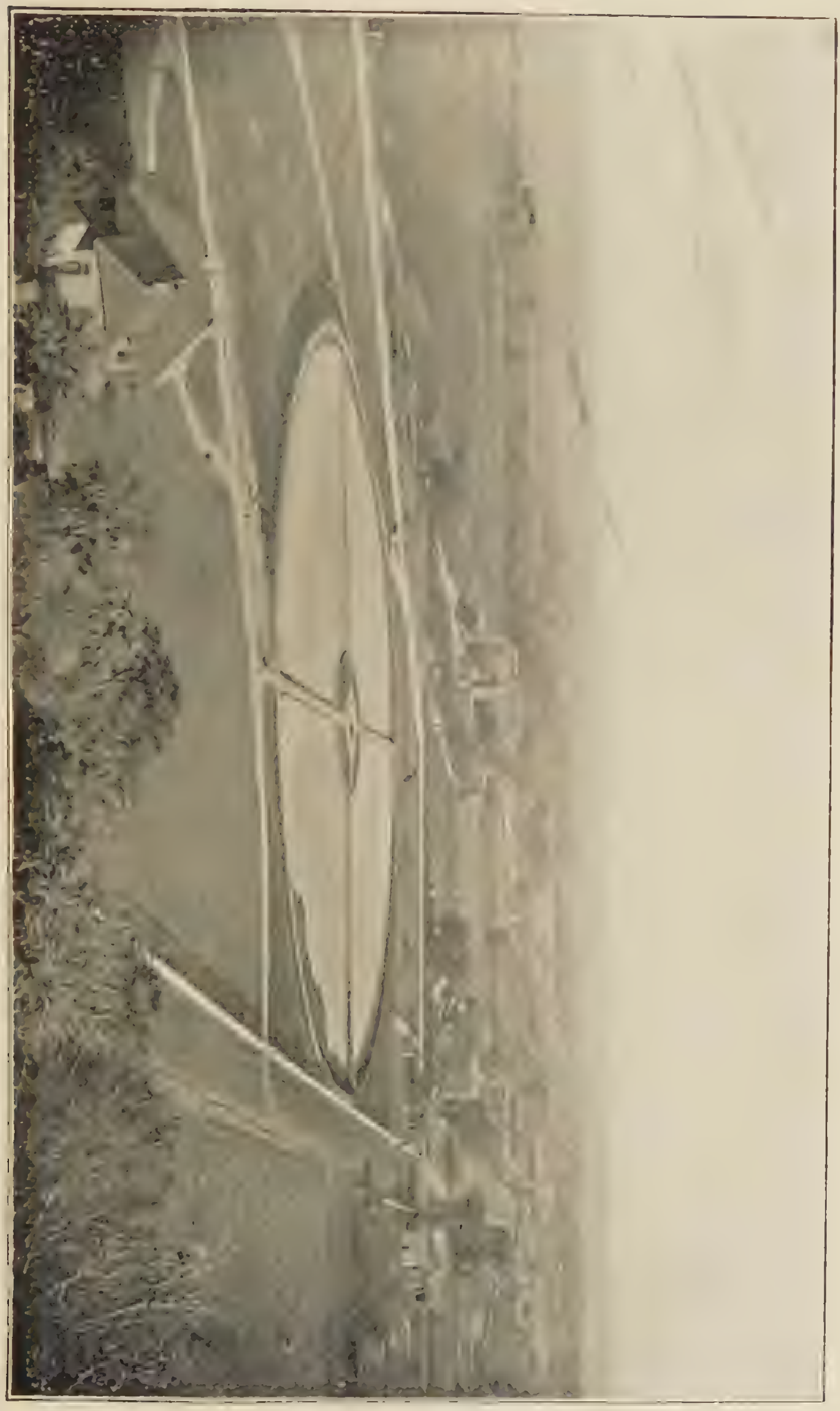
Fish cultural operations were conducted on the same lines as in the previous year. Ponds X, Y, Z, and W were used for the propagation of large-mouthed bass and crappie, and two of the 80-foot stock ponds were devoted to the culture of rock bass. Owing to the limited amount of space and the poor results attained at other stations in the propagation of the small-mouthed bass, work with that fish was discontinued. At the beginning of the fiscal year the bass ponds appeared to contain a great number of young fish, and it was then thought there would be a good crop for the fall distribution, but in July they commenced dying in large numbers, probably on account of the scarcity of natural food. An effort was made to collect natural food for them from the river bottoms along the Maquoketa River, but the supply was insufficient. The ponds were then drawn down and the fry placed in troughs, and an effort was made to feed them chopped beef and liver, but for some reason they did not thrive on it, possibly because of their weak condition when transferred, and only a few were saved for the fall shipments. These were distributed to applicants in Iowa.

Early in April the adult bass were placed in the breeding-ponds, and on May 8 the first nest was discovered in pond Z. The temperature of the water at this time was 61°. Nests were seen in the other ponds on the 10th, and on June 3 the first school of young fish was observed in pond Z. Schools were subsequently observed in the other ponds. Quite a number of nests built in the mud near the edges of the ponds contained fungused eggs, and these proved a total loss. The indications at the close of the year are that the output will be larger than that of the previous season. A lot of 3,000 young bass, 1¼ inches long, have already been taken from pond Z and placed in troughs, and the experiment of feeding them maggots is being tried. Up to the end of June several of the bass were still spawning.

The adult crappie were placed in pond W in April. They nested in May, and on June 21 two schools of young fish made their appearance. This pond contains an abundance of natural food, and it is thought the results will be fair.

During the summer of 1898, 1,183 rock bass were taken from the 80-foot stock-ponds, this number being the result of the spring spawning. In the spring of 1899, 30 adult rock bass were collected from the river and placed with the adults already on hand, 27 being placed in each of the two rearing-ponds. The fish were seen spawning late in June.

On July 1 there were 79,598 brook-trout fry on hand. These were held until September with a loss of 21,348, when 60,000 were distributed to applicants in Iowa, and the balance held for brood stock. During the summer 700 adult trout were collected, making the total number of brood fish 1,184. The first brook-trout eggs were secured on November 1, and collections continued until the 4th of March, 286 females yielding 246,278 eggs, an average of 861. These produced 67 per cent of fairly good fry. The small percentage hatched is attributed to the



CIRCULAR POND AT SAN MARCOS STATION, TEXAS.

fact that most of the fish were only two and three years old. During the winter three consignments of eggs, aggregating 150,000, were received from Leadville in excellent condition and 138,035 fry were hatched from them. bringing the total stock to 297,097; 178,900 of these were distributed during the spring to private applicants and planted in the public waters of Iowa. The remaining fry were held to be reared as yearlings.

A shipment of 22,800 rainbow-trout eggs was received from Neosho and 200,000 lake-trout eggs from Duluth. Both consignments arrived in good condition, and the fry resulting from them were planted during the spring, most of the lake trout being planted in Okoboji and Spirit lakes. The 26,000 rainbow-trout fry on hand at the beginning of the year were distributed in the fall with the exception of 4,800 retained for brood stock.

The graylings resulting from eggs shipped from Bozeman in the spring of 1898 suffered severe losses during the summer, as it was difficult to get them to take artificial food. Plants aggregating 22,000 were made in Spring Branch and Bear Creek, and the remaining 1,450 were retained for experimental rearing.

The Loch Leven trout collected in the vicinity of the station the previous fall yielded 2,980 eggs, from which 2,665 fry were hatched. At the close of the year 1,840 remained; these will be held for brood fish.

The following stock remained on hand June 30, 1899:

Species.	Calendar year in which hatched.		
	1899.	1898.	Adults.
Brook trout	70,000	5,250	967
Rainbow trout		4,800	3,265
Grayling		1,450	
Loch Leven trout	1,840		45
Large-mouth black bass			140
Rock bass			50
Crappie			30

SAN MARCOS STATION, TEXAS (J. L. LEARY, SUPERINTENDENT).

In August work was resumed on the four ponds intended to be supplied by water wheel, and by the end of October they were completed. This addition to the pond system adds very materially to the productive area of the station, and its cost, including water-wheel and reservoir, was only $2,363.77.

The outer banks of these ponds form a large circle, 1,200 feet in circumference; in the center is a circular mound, 80 feet in diameter, in which is located the distributing reservoir 20 feet in diameter and 3 feet deep, with walls of rock and cement 2½ feet thick at base, topped with 16-inch limestone coping and completed with interwoven guard rail of half-inch iron. The circle is divided into four equal parts by 6-foot embankments, making each pond the form of a keystone, with an area of about half an acre each. The depth of the ponds at the narrow ends near the reservoir is 5 feet, and it decreases as it approaches the outer edge of the circle, the average being about 3 feet. When the ponds were filled with water it was found that the wheel would keep them abundantly supplied.

To overcome the difficulties heretofore experienced in handling bass while the work of distribution is going on, the upper end of pond M was converted into 8 retaining-pools, 6 by 16 feet. The partitions were built of brick and cement with concrete foundation, and each pool was supplied with a half-inch supply pipe. This work was done largely by the employees of the station.

In July the distribution of bass hatched in the spring of 1898 was again undertaken, 11,720 being moved by the station force. The work was then discontinued until the arrival of car No. 2, in December, when four trips were made, and 5,025 black bass, 3,015 rock bass, 1,035 crappie, and 4,000 rock bass from Neosho were distributed.

Fish-cultural work was conducted on the same lines as heretofore, the propagation of black bass being the most important feature. Incidentally, experiments were continued in the propagation of rock bass, calico bass, crappie, and bream, and carp and mud shad were reared as food for the bass. Early in the fall the brood-fish were transferred to the breeding-ponds, about 12 pairs being placed to each half acre, experience having shown that the best results are attained by so apportioning them. They commenced spawning on February 18, nine days later than the previous season. This delay was undoubtedly due to the weather prevailing during the winter, which was the coldest recorded for many years. As in the past, they deposited their eggs on the clay banks of the ponds instead of the piles of gravel provided for them. As soon as the young fish were 1½ inches long they were transferred to rearing-pools, a seine of bobinet being used.

Several experiments were conducted during the season to determine at what age it is best to transfer the young from the breeding-ponds, and from the results attained it was decided that they should be at least 1½ inches in length before being disturbed.

The following table summarizes the experiments referred to:

Size of fish.	Number of fish.	Size of pond.	Number distributed from pond.
1½ inches	1,000	6 by 16 by 1½ feet deep	735
Just after absorption of sac	1,000	Same	200
1½ inches	1,500	33 by 50 feet	1,240
Just after absorption of sac	5,000	16 by 50 feet	750

On April 18 the distribution of the fish hatched during the winter was taken up and carried on until the close of the fiscal year. During this period 69,800 young black bass were delivered to private applicants and planted in public waters, with a loss of only 100.

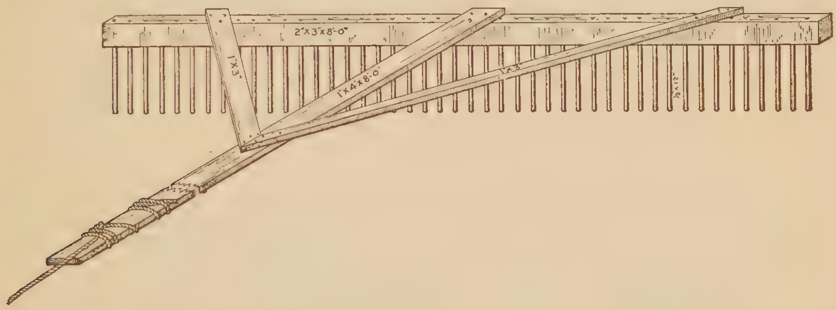
SEINING A SCHOOL OF YOUNG FISH, SAN MARCOS STATION

SEINING ADULT FISH, SAN MARCOS STATION.

It is a matter of regret that the railroads of Texas, with the exception of three—the St. Louis Southwestern, Texas and Pacific, and Fort Worth and Rio Grande—declined to give the Commission any more free transportation, as this will increase the cost of distribution very greatly. It may be of interest to know that the employees of the station traveled 18,857 miles in making the spring distribution, 9,000 of which were free. The amount expended in traveling was $773.43.

Of the fish distributed 37,550 of the black bass were planted in the following streams: Trinity River, 8,000; Brazos River, 7,150; Colorado River, 9,300; Guadalupe River, 5,000; Nueces River, 2,500; Frio River, 2,000; Medina River, 1,400; San Saba River, 1,000; San Antonio River (above city), 500; Pecan Creek, 700.

As it was impossible to obtain any rock bass in Texas, 10 adults were transferred from the Neosho station in December and placed in a pond 50 by 100 feet. At first the clear water appeared to affect their eyes, but they recovered and commenced nesting on the 23d of March. At the close of the year there appeared to be quite a number of young fish about 1½ inches long in the pond. At the same time these fish were transferred from Neosho, 12 calico bass were received and placed in a pond of the same size; these showed signs of nesting during the latter part of March and quite a number of small ones were observed on April 19.



Rake for drawing aquatic plants and moss to pond banks.

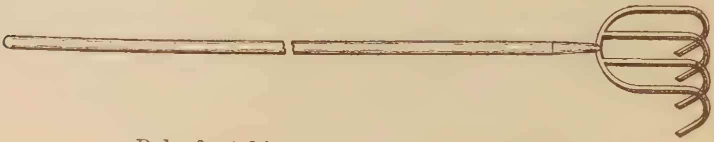
Profiting by the experience of the past year, the adult crappie were placed in a pond with carp so that the water would be kept muddy. They commenced nesting late in March and at the close of the year a number of fish about 2 inches long were observed. For breeding purposes it is not deemed advisable to place more than 50 of these fish to a half-acre pond.

An effort was made to propagate bream, and early in the winter 30 were placed in a small pond. They commenced spawning in April and had not finished at the close of the year.

Blind salamander and shrimp continued to come up in the water from the artesian well, the shrimp constantly, the salamander at intervals. Perhaps two or three would be found one week, and then for several weeks none would be seen. Many of the specimens were forwarded to Washington, some alive and some in formalin. Those sent alive were placed in 1-quart Mason jars, about three-quarters full of water. They can be kept alive easily for nine weeks, undergoing great changes of air temperature seemingly without inconvenience. One of a pair furnished to the School of Science at Austin, Tex., has been kept in an aquarium over 12 months, and about every eight days is fed a small bit of the flesh of crawfish. One was kept alive at the station, hermetically sealed in a Mason jar two-thirds full of water, for 31 days.

The trees planted the previous year have done well, taking into consideration the hot climate and almost total drought for 12 months.

The weather during the year has been very clear and dry, with high winds during the winter months and unprecedented cold, the thermometer registering 5° below zero on February 12, and remaining low for nearly a week. Ice nearly 4 inches thick formed over the ponds during this spell, but no harm resulted to the fish. Owing to the light rainfall during the past two years, the flow from the artesian well gradually dwindled, until in May it was less than 200 gallons per minute, and the overflow from the ponds was so light that the hydraulic ram could not be operated. Heavy rains in June caused the flow to become normal again.



Rake for taking aquatic plants from ponds.

NEOSHO STATION, MISSOURI (H. D. DEAN, SUPERINTENDENT).

In addition to the usual fish-cultural work the station employees made many minor improvements during the year: Two spawning-ponds were constructed at the head of pond No. 14, and quite extensive repairs were made to Nos. 14 and 15, including new piling and new standpipes. The material used for this purpose was 1½-inch cypress, coated with pine tar. A new barn was constructed in the rear of the residence, three hydrants were installed on the grounds for watering the lawns, and a refrigerator was built in the corner of the ice-house for the preservation of liver and fish-food. An artesian well, 3-inch bore, was also sunk, with a view to increasing the water supply, but the flow from it is small, and the water is strongly impregnated with sulphur.

Fish-cultural operations were on about the same lines as in the past. The fish this year were singularly free from disease, and as a consequence the output of the station was larger than usual. Of the 92,200 rainbow-trout fingerlings on hand at the beginning of the year, 83,775 were distributed in the fall, and 2,000 retained for brood stock, showing a loss of only 7 per cent for four months. Of this loss 1,500 were prob-

SAN MARCOS STATION, TEXAS—WEST SIDE OF SUPERINTENDENT'S DWELLING.

WATER-WHEEL AT SAN MARCOS STATION.

ably killed by being placed in a pond in which the piling was coated with coal tar.

The spawning season of the rainbow trout extended from December 16 to March 10, the total take of eggs amounting to 349,629, of which 225,939, or only 57 per cent, were fertilized. 125,800 eyed eggs, were sent to other stations and private applicants, leaving 100,000 to be hatched; from these there were on hand at the close of the year 57,400 fingerlings.

In May 10,000 wild rainbow trout eggs were received from California. These had been taken by the California Fish Commission at Sisson, Cal., and shipped to Leadville, where they were repacked and sent to Neosho. They produced 6,600 fine, healthy fry, which will be reared for brood stock.

The small number of eggs obtained this season and their poor quality is due to the fact that the brood-fish were in poor condition from constant handling and interbreeding, and it is hoped the introduction of new stock will bring about an improvement.

After the ponds containing the young black bass and rock bass had been carefully drawn down the fish were transferred to troughs and small pools, where they could be supplied with water of a higher temperature than it is possible to provide in the rearing-ponds. The troughs constructed over the branch proved very successful for this purpose, the temperature there being kept at 75° without difficulty. The young black bass learned to take artificial food very readily, though not so quickly as the rock bass. Of the 18,632 young black bass taken from the ponds, 16,750, or 90 per cent, were carried through the summer and successfully distributed in the fall. An accidental plant of 5,000 was made in Hickory Creek, the flood of July 31 carrying away the troughs in which they were held.

From the rock-bass ponds 32,100 young were removed to troughs, and the output in the fall amounted to 29,596. These were cared for in the same way as the black bass.

At the close of the year the stock on hand was as follows:

Species.	Calendar year in which fish were hatched.			
	1899.	1898.	1897.	1896.
Rainbow trout	64,000	1,990	600	720
Black bass			85	191
Rock bass.				55
Strawberry bass			71	48
Golden ide				12

Leadville Station, Colorado (E. A. Tulian, Superintendent).

At the beginning of the year there were on hand 340,000 brook trout, 25,000 Loch Leven trout, 41,500 grayling, 3,000 rainbow trout, 153,600 black-spotted trout eggs, and 4,900 rainbow-trout eggs. The rainbow-trout eggs were a total loss, but, except the grayling, which were distributed in July and August, the balance of the stock was carried until fall with comparatively light losses. Arrangements were made during the summer for the collection of eggs at all of the points heretofore operated, and at a number of private ponds and lakes. The first eggs were obtained October 7 from brood-fish at the station, and collections continued coming in until late in December.

The following table shows the number collected at the various points, spawning period of the fish, number of eggs lost and fry hatched:

Source.	Spawning period.	Eggs collected.	Eggs lost.	Fry hatched.
Station	Oct. 7 to Dec. 17	292, 100	48, 600	62, 300
Uneva Lake	Oct. 30 Nov. 21	76, 000	6, 650	69, 350
Smith Lake	Oct. 28 Dec. 5	138, 000	37, 750	100, 250
Ridgway Lake	Oct. 26 Dec. 13	484, 700	119, 200	360, 100
Wellington Lake	Oct. 29 Dec. 1	842, 200	241, 900	499, 300
Youngs Lake	Oct. 22 Nov. 26	109, 900	42, 900	67, 000
Decker Lake	Nov. 3 Nov. 27	1, 328, 000	696, 720	533, 280
Musgrove Lake	Oct. 21 Nov. 29	349, 900	126, 450	122, 950
Derry Lake	Nov. 7 Nov. 16	36, 000	1, 400	34, 600
Total		3, 656, 800	1, 321, 570	1, 849, 130

Of the total collections, amounting to 3,656,800, 485,600 were transferred to other stations of the Commission and to private applicants. On May 1 there remained at the station 778,790 brook-trout fry belonging to the Commission, and 1,016,340 belonging to private parties. As Congress had made a special appropriation to be used in repairing and remodeling the station, it was necessary to distribute all of these fish before the close of the fiscal year; 200,000 were shipped by car No. 2 to the Bozeman station, and the balance given to applicants in Colorado, South Dakota, Nebraska, Montana, Utah, Washington, Oregon, and Idaho. The fry owned by private parties were turned over to them.

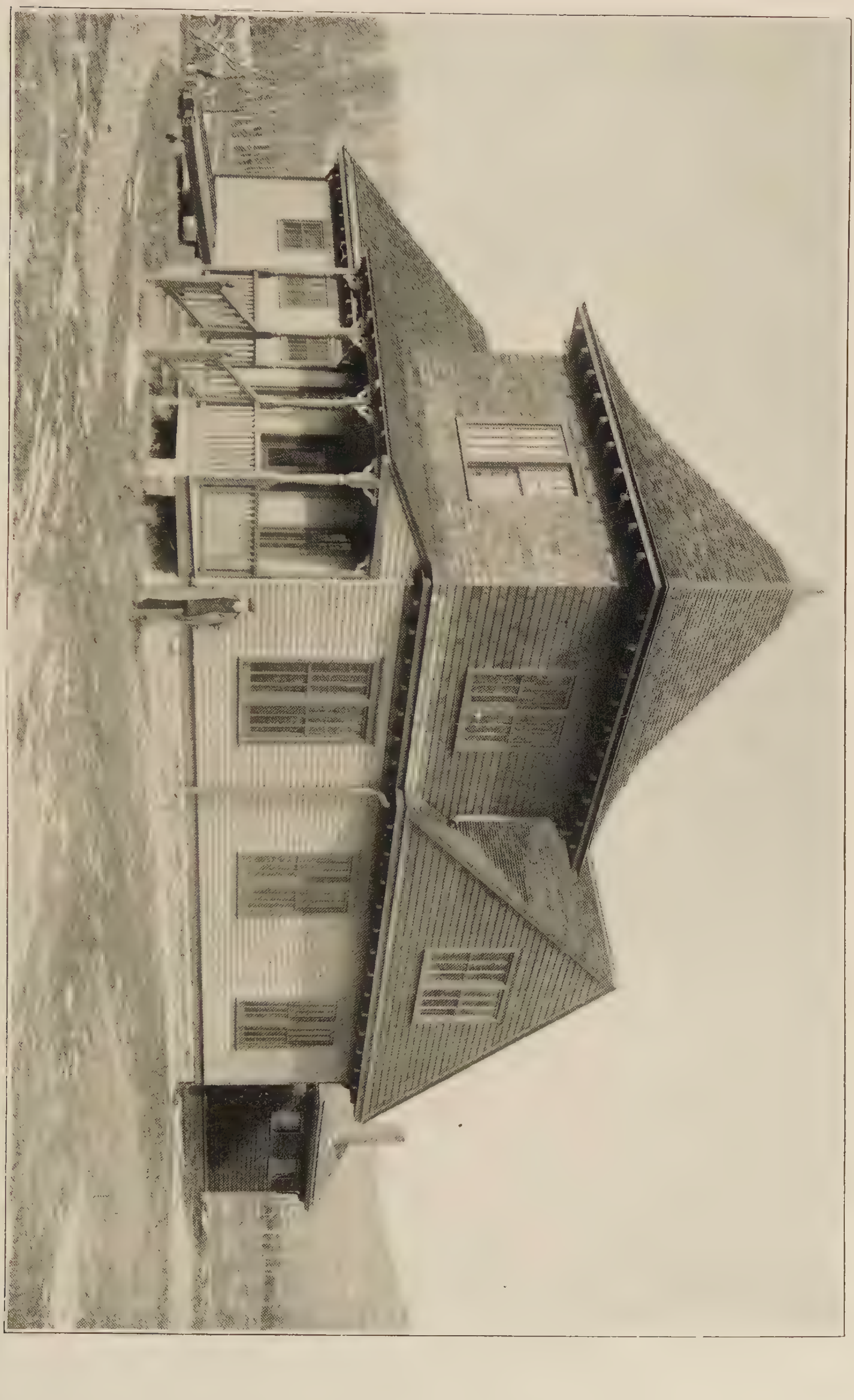
Steps were taken early in the spring to again undertake the collection of black-spotted trout eggs at Freeman Lake, and also at the Grand Mesa Lakes. Only 18,500 were secured at the former point, but the take at the Grand Mesa Lakes amounted to 1,727,000. By June 30 143,000 had been transferred to the station, and 1,584,000 were in troughs at the lakes waiting for the eye-spots to develop. The results were exceedingly gratifying, as all efforts in past years to find a good collecting field for black-spotted trout eggs had proved fruitless.

In April and May 66,900 rainbow-trout eggs were collected at Lake Loveland and Twin Lakes. The loss on the Lake Loveland eggs during incubation was very heavy, amounting to over 54 per cent of the take. This was attributed to the freezing of the eggs in the pan just after they were taken. Quite a number of young trout were seen in the lake, and it is believed that much larger collections can be secured there next season.

In addition to eggs already mentioned, 25,000 rainbow-trout eggs were received from the California Fish Commission station at Sisson, Cal., 10,000 of them being reshipped to Neosho.

The stock of Loch Leven trout at this station has died out, the only

PLATE XVIII.



BOZEMAN STATION, MONTANA—HATCHERY BUILDING.

eggs collected being 15,500, obtained in December from the Ridgway Ponds. These hatched with comparatively small loss.

As there had been numerous calls for lake-trout fry in the Rocky Mountain regions, 25,000 eggs were transferred from Duluth in January and arrived in excellent condition, the loss in hatching amounting to only 200. During June 10,000 fry were shipped, and 11,700 remained on hand at the close of the year.

The following shows the stock of fish and eggs on hand at the close of the year:

Species.	Calendar year in which hatched.					
	1899.	1898.	1897.	1896.	1895.	Eggs.
Brook trout	35,000				104	
Loch Leven trout	300		80	100		
Black-spotted trout			200			1,651,000
Lake trout	11,700					
Rainbow trout	55,500					
Grayling		2,700				
Total	102,500	2,700	280	100	104	1,651,000

BOZEMAN STATION, MONTANA (JAMES A. HENSHALL, SUPERINTENDENT).

During the fiscal year a number of improvements were made at this station, including the installation of a heating plant in the superintendent's residence. The warm spring was raised 4½ feet, so that the water could be flumed across the creek and used for moderating the temperature in the rearing-ponds, and 12 new ponds, 10 by 25 feet, were constructed with a complete system of water-supply and waste pipes. In June a freshet carried away the flume to the warm-water spring and the south abutment of the bridge, near the main entrance to the grounds.

All of the fish on hand at the beginning of the year were distributed during the summer and fall, the grayling fry being liberated early in July, owing to the great difficulty experienced in feeding them.

Arrangements were made the following winter for collecting black-spotted-trout eggs at Henry Lake and grayling eggs at Red Rock, also for the operation of a private hatchery on the ranch of Mr. Burton Vincent, 4 miles from Anaconda, on Warm Spring Creek.

The Henry Lake station was opened April 3 and operated under the direction of Mr. W. F. Jarvis, fish-culturist at Bozeman. From the 407 ripe trout captured in the lake and in Howard and Meadow creeks 615,000 eggs were secured, the fish taken from the lake averaging 1,500 eggs each, and those from Meadow Creek 2,400. During May and June 507,000 of these eggs were transferred to Bozeman and 50,000 were hatched and planted in Henry Lake. The temperature of the water during the season varied from 43° to 57°. On June 27 the station was closed and the apparatus stored for the season.

The substation at Anaconda is located on the ranch of Mr. Burton Vincent, who has equipped a small hatchery to be operated by the

Commission on shares. Mr. G. H. Tolbert was detailed for duty at this point, and took charge of the work on March 15. Under his direction, runways were made to connect the several ponds, which were originally beaver-dams; traps were put in for the capture of adult trout, and live-boxes constructed. The first eggs were taken on May 7, the last July 3. The results secured were not as large as had been anticipated, as only 250,000 eggs were obtained. Of these, 194,600 were shipped to Bozeman and the rest were hatched and planted in the ponds. These ponds contain an abundance of natural food, such as Gammarus, and the fish in them are healthy and well fed.

The Red Rock Lake station was opened on April 6, Mr. A. J. Sprague, fish-culturist of the Leadville station, being in charge. The temporary hatchery, erected the previous fall, was equipped with troughs and a suitable trap was placed in the creek. The water supply to the hatchery was also increased by enlarging the spring and raising it to a higher level. As more grayling were taken than could be utilized, the trap was fished only during the day. The first eggs were collected May 14 and the last on June 29, 5,300,000 being taken in all.

As some difficulty had been experienced during the previous season in handling grayling eggs on flat trays, both the McDonald jars and the Stone-Williamson baskets were employed this year, and with very satisfactory results, no trouble arising from fungus or from bunching of the eggs, as heretofore. It would appear that grayling eggs should be eyed under a water pressure from above rather than with a lateral current.

Owing to an unforeseen delay in the delivery of the shipping-boxes, it became necessary to hatch the bulk of the eggs at the station and deposit the fry in adjacent streams. Of those transferred, 750,000 were sent to Bozeman, 100,000 to St. Johnsbury, 100,000 to Duluth, 67,000 to Northville, 25,000 to the Wyoming Fish Commission, and 50,000 to the Rhode Island Fish Commission.

The fry hatched at the station were planted as follows: 3,000,000 in Elk Creek, 100,000 in Elk Lake, 800,000 in Picnic Spring Creek, and 75,000 in Hidden Lake.

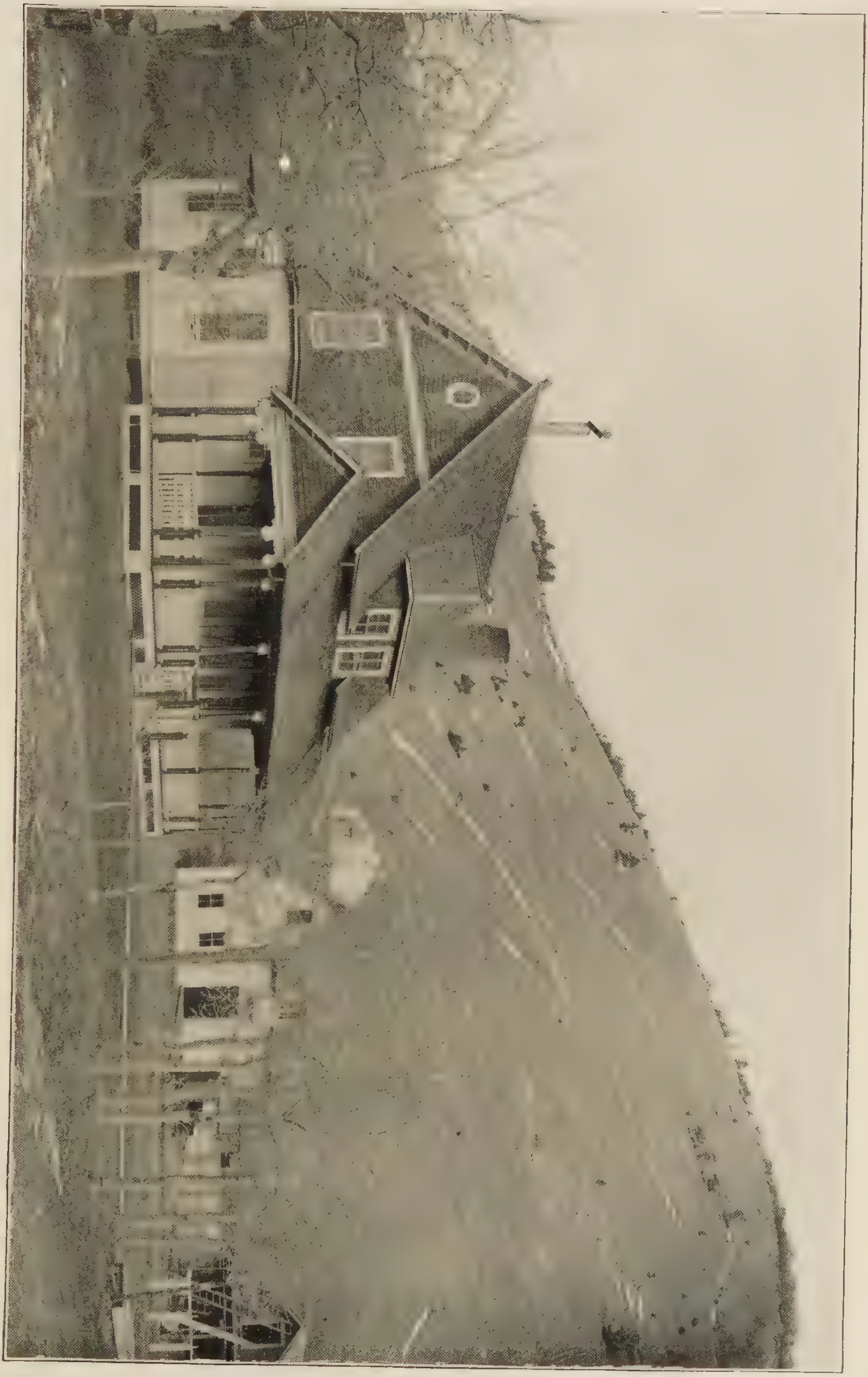
During the winter and spring 130,000 brook-trout eggs, 50,000 rainbow-trout eggs, and 15,000 steelhead-trout eggs were received at the station from different points. These were hatched and the fry will be held for rearing.

At the close of the year there were on hand the following:

Species.	Calendar year in which fish were hatched.			
	1899.	1898.	1897.	Eggs.
Brook trout	68,800	2,100	*1,456	....
Black-spotted trout	....	4,945	80	584,000
Steelhead trout	....	190	6,370	14,700
Rainbow trout	20,000	....	....	....
Grayling	....	....	....	590,000

*Received 780 from Leadville station.

PLATE XIX.



BOZEMAN STATION, MONTANA, SHOWING STABLE AND NEW WAGON-SHED.

CLACKAMAS STATION, OREGON (W. F. HUBBARD, SUPERINTENDENT).

Owing to the difficulties experienced in past years in constructing a rack across the Clackamas strong enough to withstand the freshets that occur every fall, and as arrangements had already been made to collect eggs on the upper river, the Salmon River, and the Little White Salmon, it was decided not to attempt collections on the lower river in the vicinity of the station, but to use the hatchery for hatching and rearing fry from eggs transferred from the substations mentioned. As the season advanced, however, it became apparent that collections at these points would be light, and 704,000 eyed eggs were purchased from local fishermen. The transfers from other stations were as follows: 4,926,000 from the Little White Salmon, shipped between October 26 and November 8; 16,200 from the Salmon River and 2,000,000 from Battle Creek, received January 6; making a total of 7,646,200 salmon eggs handled at Clackamas. It became necessary during the winter to erect rearing-troughs out-of-doors to care for the fry.

With the view to increasing the fry-holding capacity of the hatchery a number of experiments were made, and it was found that twice as many eggs could be cared for by suspending baskets of fine-mesh wire cloth in the troughs midway between top and bottom, thus permitting the carrying of two sets of fry in each trough, the usual number on the bottom, and the same number in the basket. These experiments were not made until the season was well advanced, but they demonstrated clearly that the baskets could be used in this way with excellent results, though the water supply was unusually bad, due to the washing down of mud by the heavy rain storms during the winter.

The fry were planted from time to time during the winter and spring in the Clackamas River, the last deposit being made on May 11. The total number planted was 7,489,206, showing a loss of only 150,974 on the eggs received.

Early in March J. W. Berrian, J. N. Wisner, and E. C. Greenman were sent to the falls of the Willamette River, near Oregon City, to collect eggs of the steelhead. A tent was erected for the accommodation of the men, and water was obtained from a steamboat basin near by for supplying the hatching-troughs, erected in the open air near the tent.

A party of fishermen operating a fish-wheel in the vicinity agreed to turn over all the fish captured by them, and it was arranged so that the fish caught in the wheel would slide through a trough into a live-box anchored in the water. From this box they were transferred to larger boxes, where they were held until ripe. The live-boxes were 8 feet square and 6 feet deep, constructed with adjustable bottoms. The first fish caught by the wheel was on April 9, and up to May 2 only 61 females and 22 males were obtained from that source. As indications did not point to any increase in the catch, steps were taken to obtain additional supplies of fish from other fishermen who were operating dip nets on an island under the falls. From this source 209 were secured—153 females and 56 males.

The fish from the island, taken in dip nets, were in much better condition than those from the wheel. A few were also secured from gill nets, but they soon died from injuries. The loss on the fish held in live-boxes was considerable, though every possible effort was made to keep them alive until ripe.

Eggs were obtained from 160 females, the first being taken on April 28 and the last on May 24. The total collection amounted to 393,000, of which only 167,000 developed to the eyed stage. These were shipped as follows: 93,000 to Duluth, 15,000 to Bozeman, 21,000 to the Connecticut Fish Commission, and 30,000 to Northville. The remaining 8,000 were hatched and transferred to Clackamas, where they were liberated in Clear Creek.

In addition to these, 3,501 steelhead eggs were received from Salmon River, which produced 625 fry. These were planted with the other lot.

Upper Clackamas Station, Oregon.

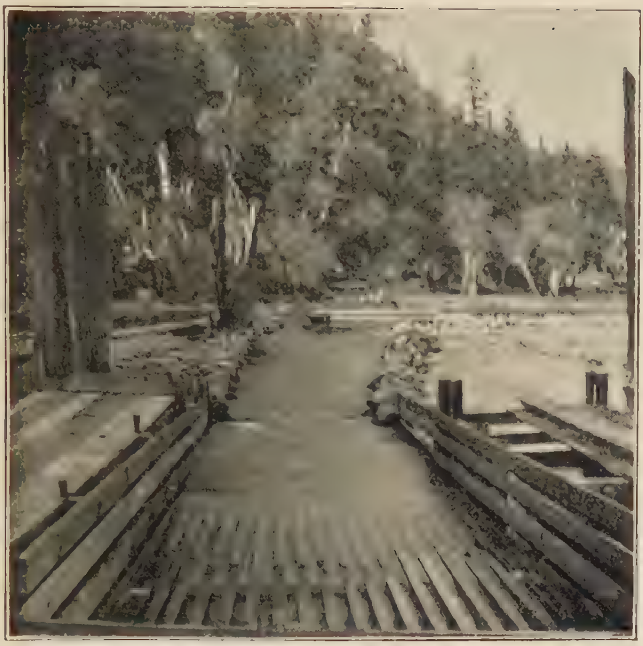
Early in the spring arrangements were made to have a rack across the Clackamas and one across Oak Grove built by contract. They were finished by the last of May, so as to prevent any salmon passing above the station. On July 1 men were employed to put the apparatus in order for the season's work. Operations were conducted on substantially the same lines as in previous years, except that a water wheel was made and placed in the river to furnish water to some of the temporary hatching-troughs on the river bank. This wheel was built upon a raft anchored at the head of a riffle, and was so arranged that the water in the river would revolve the wheel. Buckets fastened to the rim of the wheel raised the water and emptied it into a flume, from which it was conveyed to the hatching-troughs. The regular water supply to the hatchery failed early in the season on account of dry weather, but as the wheel furnished an ample supply for the troughs, no inconvenience resulted.

The first eggs were collected July 19 and the last on August 29. During this period 675 females were stripped, yielding 3,421,000 eggs, from which 2,930,000 fry were hatched and planted in October, November, and December in the headwaters of the Clackamas River.

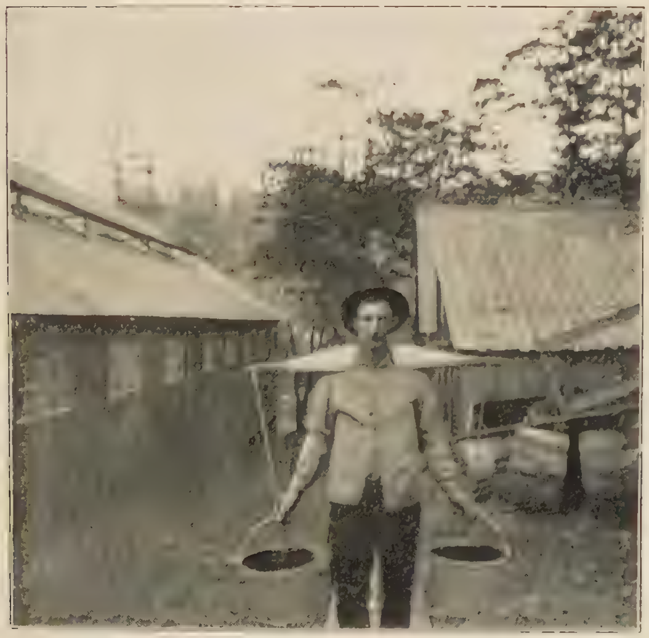
The station was closed in December, and put in charge of a custodian, and on April 1 it was turned over to the State Fish Commission.

Salmon River Station, Oregon.

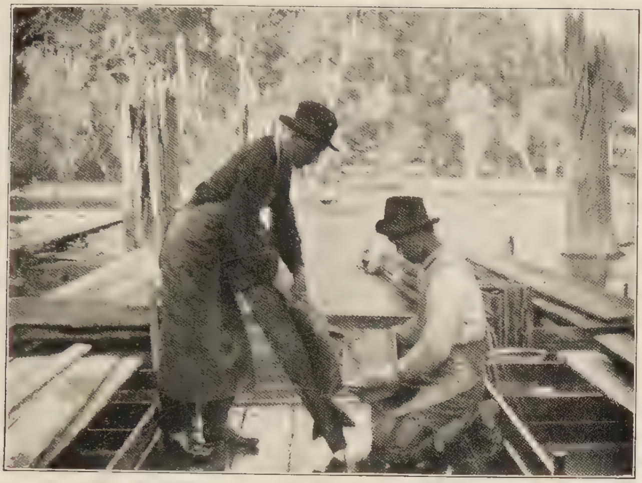
Arrangements were made in the spring with Thomas Brown to furnish the Commission all the salmon eggs collected by him on this river at the rate of 40 cents per 1,000, eyed. The rack was built early in June, before any salmon ascended the stream, and in the first part of the summer the prospects for a good season's work seemed bright, as many



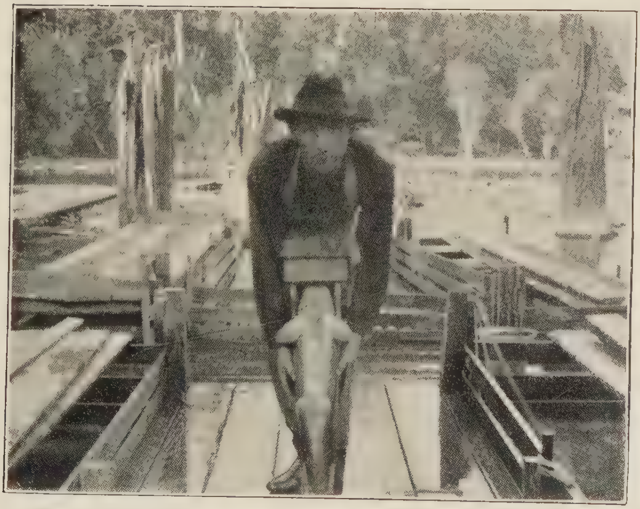
SALMON-PENS AND RETAINING-RACKS AT LITTLE WHITE SALMON STATION



CARRYING EGGS FROM SPAWNING-GROUNDS TO HATCHERY, AT LITTLE WHITE SALMON STATION.



TAKING SALMON EGGS AT LITTLE WHITE SALMON STATION.



STRIPPING LARGE SALMON.

salmon were observed in the pools below the rack. Before they were ready to spawn, however, many of them were killed and others injured by explosives used by people in the vicinity, so that very few eggs were secured.

The spawning season commenced late in July and lasted until September 1, the total collections amounting to 745,200 eyed eggs. Of these, 27,000 were shipped to Portland, to the late Hon. H. D. McGuire, where they were hatched at the Industrial Exposition, forming a very interesting exhibit; 16,000 of the last eggs taken were sent to Clackamas, and the balance were hatched, the fry resulting from them (650,355) being liberated in the Salmon River during the fall months. After the last of them had been disposed of, the station was closed until March 1, when an attempt was made to collect steelhead eggs. A rack was finished on March 14, but was destroyed by high water on April 11. It was rebuilt, but too late to secure any eggs.

The operations resulted in the collection of 22,000, only 3,500 of them surviving to the eyed stage. These were transferred to Clackamas on May 14.

The State Fish Commission took charge of this station on June 15.

Little White Salmon Station, Washington.

This station was opened July 13, with S. W. Downing in charge, assisted by J. W. Berrian and J. N. Wisner. As more eggs had been taken the previous season than could be handled in the hatchery, work was at once commenced on an additional hatchery, which was practically completed at the opening of the spawning season. This building is a frame structure 100 feet long by 40 feet wide, and is equipped with 80 troughs 1½ feet wide by 16 feet long. The mess and bunk houses were also enlarged and an office building erected. The rack across the river was completed on August 8, but no salmon were observed near it until September 7, though they had been seen jumping in the lake at the mouth of the river some time before that.

Fishing commenced September 11, and was carried on daily until October 3, resulting in the collection of 7,176,000 eggs. The run of fish was unusually light, and only about one-fourth as many eggs were secured as had been anticipated, though all the fish that entered the river were captured, the seine being hauled night and day.

In accordance with the usual custom, all females were killed before being stripped. Of the eggs collected 4,926,000 were sent to Clackamas station. From the balance 1,791,000 fry were hatched and liberated in the Little White Salmon River, the plants being made between December 8 and 13. As soon as all of them had been disposed of, the station was closed and left in charge of a laborer, who was employed during the winter in completing the wagon road commenced the previous year and in doing other necessary work around the hatchery.

This station is fully equipped for handling 25,000,000 to 30,000,000 eggs per season, and can be worked on a very economical basis.

BAIRD STATION, CALIFORNIA (G. H. LAMBSON, SUPERINTENDENT).

Early in the summer the rack was put in place across the river to stop the ascent of the salmon. It had been observed for several years that many unripe fish were driven from the spawning-pools below the rack, backed down the river, and lost, and to guard against this a retaining-rack was constructed early in July about 100 yards below the pool. This rack is 190 feet long and is built on six piers placed 28 feet apart. The piers were made by bolting timbers together in the form of a triangle, the long angle upstream, and filling in the spaces with stone. There are five traps in the rack which permit the fish to pass upstream, but will not allow them to return. The weirs, whim, seine reel, boats, and other apparatus were placed in order early in the summer and when the spawning season opened on August 15 everything was in readiness for a good season's work.

The regular summer fishing commenced August 15, three ripe females being taken on that date, and closed September 17, with a collection of 13,445,900 eggs. Of these 1,467,000 were lost in incubation, and 11,340,000 were shipped, 100,000 being sent to Japan, 25,000 to France, 25,000 to New Zealand, 35,000 to the Trans-Mississippi and International Exposition at Omaha, and the remainder to the California hatcheries at Sisson and Eel River.

The fall run commenced November 5 and closed December 27. During this time 3,122,700 eggs were collected, making a total for the two runs of 16,568,600. Of the eggs retained at the station 3,263,560 were hatched and planted in the McCloud River, with a loss of only 112,610 fry during the sac stage. The take was larger than ever before and it became necessary to erect a number of troughs outside the hatchery to care for the surplus. These troughs were made of green lumber and proved very unsatisfactory, causing the loss of the surplus fry. The baskets were also overcrowded, as it was necessary to place 40,000 in each, and this probably increased the loss during incubation.

The methods were practically the same as heretofore. The eggs were stripped in a pan moistened with water, the milt being added at the same time and the mass gently stirred with the hand or a feather until thoroughly mixed. About half a cup of water was then added to the mass. This process was repeated with four or five other pans, when they were all poured into a bucket holding about 50,000 eggs and fresh water added from time to time until they could be taken to the hatchery. The buckets containing eggs are handled very carefully, and on arrival at the hatchery the eggs are measured into baskets with dippers holding an average of 1,800 each. After being placed in the baskets they are picked over every other day and all dead and white ones removed until the fifth day, when they are covered and left undisturbed until the embryos are sufficiently developed to permit handling. At an average temperature of 50° they will reach this stage in about fifteen days, but great care should be exercised in handling

PLATE XXII.

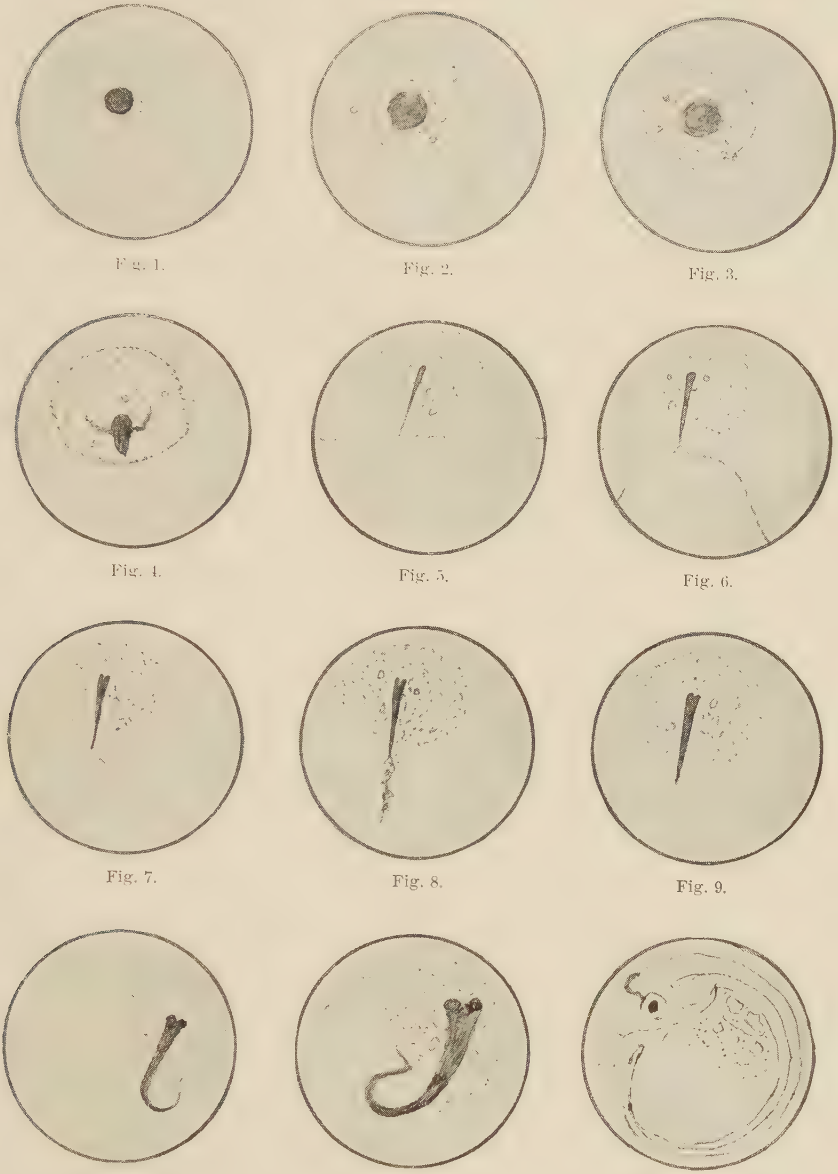


Fig. 1. Fig. 2. Fig. 3.

Fig. 4. Fig. 5. Fig. 6.

Fig. 7. Fig. 8. Fig. 9.

Fig. 10. Fig. 11. Fig. 12.

DEVELOPMENT OF SALMON EGGS FROM TWO DAYS OLD TO THIRTY DAYS AT 54° F.

Fig. 1. Appearance of egg two days after fertilization, and while it can be handled.
Fig. 2. Egg at four days, when it can be picked over but must be handled with extreme care.
Fig. 3. Egg at six days, when it should not be touched.
Figs. 4, 5, 6, 7, and 8. Egg on the seventh, eighth, ninth, and tenth days, when it is very tender and can not stand handling.
Fig. 9. Egg at eleven days, when it can be handled but with extreme care.
Figs. 10, 11, and 12. Egg at fourteen, twenty, and thirty days, when very hardy.

After the loop, shown in figs. 6, 7, and 8, has closed and all trace of it disappeared, as in fig. 9, the egg can be picked over, and from that time on it grows constantly more hardy and can be shipped.

(Drawings by Leroy Ledgerwood.)

them the first two or three times. When the troughs are first uncovered the eggs are found buried in the mud and sediment to the depth of $\frac{1}{4}$ inch or more, but this is easily removed by raising the basket slightly and settling it back in the trough. A little fungus also develops, but the loss from this cause is slight, amounting this season to less than 200,000 on 16,000,000 eggs. As soon as the eye-spots appear the eggs are packed in the Annin shipping-case and sent to the California hatchery.

As the temperature of the water at Baird varies constantly, observations of the eggs at different stages were made, as a result of which the employees of the station are now able to determine from the appearance of the eggs, after knowing the mean temperature of the water, not only the age of the eggs, but their fitness for shipment. With a mean temperature of 54° the egg enters the critical stage at the end of the fourth day, fig. 2. At the sixth day they are very tender and remain so for several days. On the fourteenth day (fig. 10) they are hardy and can be picked without danger. At 54° they can, with care, be picked over on the fourth day, but from that time to the end of the eleventh or twelfth day they should be left undisturbed.

This information is important where there are many millions of eggs to be cared for, as it saves the necessity of keeping an exact record of the length of time the various lots have been under cover, and does away with the old custom of washing a basket for the purpose of determining whether or not they will stand handling, this method destroying many eggs in experimental washing. The figures show the development of the egg at 54°, but the same would be true at any temperature except that with colder water more time is required for the egg to reach the various stages.

Owing to the crowded condition of the hatchery it became necessary to plant some of the eggs from the fall run before the sac was nearly absorbed, and it is feared that quite a large proportion of these were destroyed, as several trout captured were full of young salmon. The majority of the fry, though, were planted at the proper age, and it is believed that comparatively few of these were eaten by trout, judging from an examination of the stomachs of those caught.

In a pond 50 feet long, 4 feet wide, and 6 inches deep near the edge of the river, and fed by the overflow from the hatchery, 20,000 young salmon were placed. They remained here for nearly a month and were in fine condition when liberated.

The results secured this year were not due so much to the large run of salmon as to the fact that all fish entering the rack were held there by the retaining-rack. Many more eggs could have been taken, as the crew fished only four hours each day, but as the hatchery was overcrowded it was not deemed advisable. After the salmon were stripped they were killed and given to the Indians, who came from far and near for them. The flesh is dried in the sun, and this forms their main food supply during the winter months.

Early in the spring, immediately after the fry had been planted, the old hatchery was torn down, and by April 15 everything had been cleared away and the grading of the site for the new hatchery commenced. This building, which was completed on June 29, is a frame structure 120 by 40 feet, with side walls 12 feet high; it has 36 windows on the sides and ends and 12 skylights in the roof. The sides and ends are sheathed with rustic lumber and the floor is of 1½ by 6 inch yellow pine laid half an inch apart. The studding and rafters are of spruce. The building is covered with redwood shingles and is equipped with sufficient troughs to care for 20,000,000 eggs. A new centrifugal pump was purchased and the water-wheel rebuilt to insure an abundant supply for the new hatchery. Contracts were also entered into for the erection of a steam plant, which will furnish several hundred gallons of water per minute, in the event of an accident to the wheel.

At the close of the year the rack was again placed across the river. It was noticed that the run of salmon which usually makes its appearance in the McCloud River about the last of March did not appear this season. In the pool below the rack on June 30, where there are usually several thousand fish, only a few were found. This scarcity was attributed to the discharge of refuse from the smelters at Keswick, and as thousands of dying fish were observed, the matter was investigated by the California Fish Commission, who reported that the mortality was not caused by the discharge of silt from the smelters, but from poison in a spring near Keswick.

The following shows the number of fish and eggs handled during the summer run:

Date.	Fish spawned.	Eggs taken.	Eggs lost.
Aug	16	62,400	11,603
18	21	96,390	7,589
19	29	144,635	7,674
20	16	80,345	5,932
22	51	248,205	9,853
23	34	176,785	14,416
24	55	250,000	3,630
25	86	418,540	26,213
26	72	353,700	11,680
27	83	401,800	18,270
28	76	386,700	13,450
29	73	361,400	10,375
30	162	783,300	36,480
31	131	616,100	25,650
Sept. 1	157	708,500	27,170
2	141	694,100	23,800
3	146	724,000	19,625
4	133	614,800	37,550
Sept. 5	138	617,100	43,225
6	113	511,800	75,498
7	233	1,082,300	113,150
8	144	684,500	352,700
10	148	703,900	394,500
11	111	495,000	2,700
12	97	435,200	32,675
13	103	443,500	46,050
14	77	348,200	20,375
15	38	156,500	15,880
16	64	273,100	19,645
17	70	296,300	19,825
18	21	86,200	7,917
20	30	118,500	9,700
22	19	72,100	2,350
Total	2,888	13,445,900	1,467,150

BATTLE CREEK STATION, CALIFORNIA (G. H. LAMBSON, SUPERINTENDENT).

The station was opened September 10, and steps were at once taken to repair the racks and weirs and to equip the hatchery for the reception of eggs. By the middle of October the main rack across the creek and the two retaining-racks at the mouth had been completed. The main rack, which is 273 feet long, was built in 1897, at an expense of

$1,650, and has proved very satisfactory, having withstood the freshets of the past season without damage. This rack was completed first, in order to prevent the salmon from ascending the creek beyond the hatchery. The retaining-racks at the mouth of the creek were then rebuilt, to keep the salmon that had entered from returning to the river. On October 22 the first haul of the seine was made, and 29 ripe females were secured.

Egg collections commenced on the 26th, the 169 females stripped on that date yielding 990,000 eggs. Fishing continued uninterruptedly from this time till December 9, when the crew was discharged and the station practically closed. During this period 484 seine-hauls were made and 3,938 females captured and placed in the pens. Of these, 3,876 yielded 19,429,000 eggs, of which 1,059,000 were lost in incubation, and 18,369,000 were eyed and shipped to other stations, the California Commission receiving 13,687,500. The last shipment was made on January 14, the day the station was closed.

The following table shows the daily catch of fish, eggs taken, eggs lost, and water temperature during the season:

Date.	Females caught	Eggs taken.	Eggs lost.	Water temperatures.	
				6 a.m.	6 p.m.
1898.				°F.	°F.
Oct. 22	29	....	....	55	57
23	97	....	....	56	58
24	34	....	....	52	55
25	48	....	....	51	55
26	31	990,000	....	52	56
27	46	234,000	2,000	51	55
28	29	230,500	....	52	55
29	70	262,000	....	52	55
30	60	270,000	....	53	56
31	82	354,000	2,000	54	56
Nov. 1	96	342,000	....	50	53
2	103	356,000	....	49	54
3	126	818,000	2,000	51	53
4	127	616,000	....	51	55
5	99	658,000	2,000	52	55
6	103	482,000	2,000	52	55
7	129	598,500	3,000	47	52
8	133	682,000	3,000	47	49
9	97	496,000	8,000	45	49
10	146	468,000	8,000	45	50
11	70	626,000	12,000	47	49
12	105	542,000	12,000	46	50
13	135	464,000	12,000	46	51
14	148	812,000	14,000	47	51
15	118	732,000	15,000	48	51
16	200	958,000	12,000	48	50
17	155	920,000	10,000	52	53
18	175	862,000	10,000	49	53
19	116	584,000	15,000	51	52
20	141	562,000	20,000	48	49
21	87	460,000	21,000	46	47
22	63	380,000	23,000	47	48
23	51	284,000	25,000	45	48
25	72	162,000	26,000	43	47
26	53	298,000	30,000	43	49
27	60	258,000	36,000	45	47
28	60	420,000	22,900	49	50
29	69	228,000	32,000	51	53
30	74	258,000	30,000	50	51
Dec. 1	70	374,000	30,000	48	50
2	67	304,000	24,000	46	48
3	75	374,000	22,000	45	48
4		214,000	....	46	49
5	38	....	21,000	46	48
6	38	286,000	29,000	45	47
7	16	....	30,000	44	46
8	21	146,000	30,000	44	45
9	6	64,000	30,000	44	46
10	......	....	40,000	41	44
11	......	....	40,000	41	43
12	......	....	40,000	40	44
13	......	....	40,000	42	45
14	......	....	30,000	45	46
15	......	....	30,000	44	47
16	......	....	....	44	46
17	......	....	....	45	48
18	......	....	....	47	49
19	......	....	30,000	48	49
20	......	....	30,000	48	48
21	......	....	30,000	45	46
22	......	....	20,000	42	46
23	......	....	28,000	42	45
24	......	....	....	42	45
25	......	....	....	42	45
26	......	....	....	45	47
27	......	....	....	44	47
28	......	....	30,000	46	48
29	......	....	....	47	48
30	......	....	....	43	45
31	......	....	....	41	43
1899.					
Jan. 1	......	....	....	41	43
2	......	....	....	40	42
3	......	....	....	42	44
4	......	....	44,000	40	44
5	......	....	....	42	44
6	......	....	....	43	43
7	......	....	....	43	45
8	......	....	....	43	44
9	......	....	....	45	47
10	......	....	....	43	45
11	......	....	....	41	43
12	......	....	10,500	43	45
	3,938	19,429,000	1,059,000		

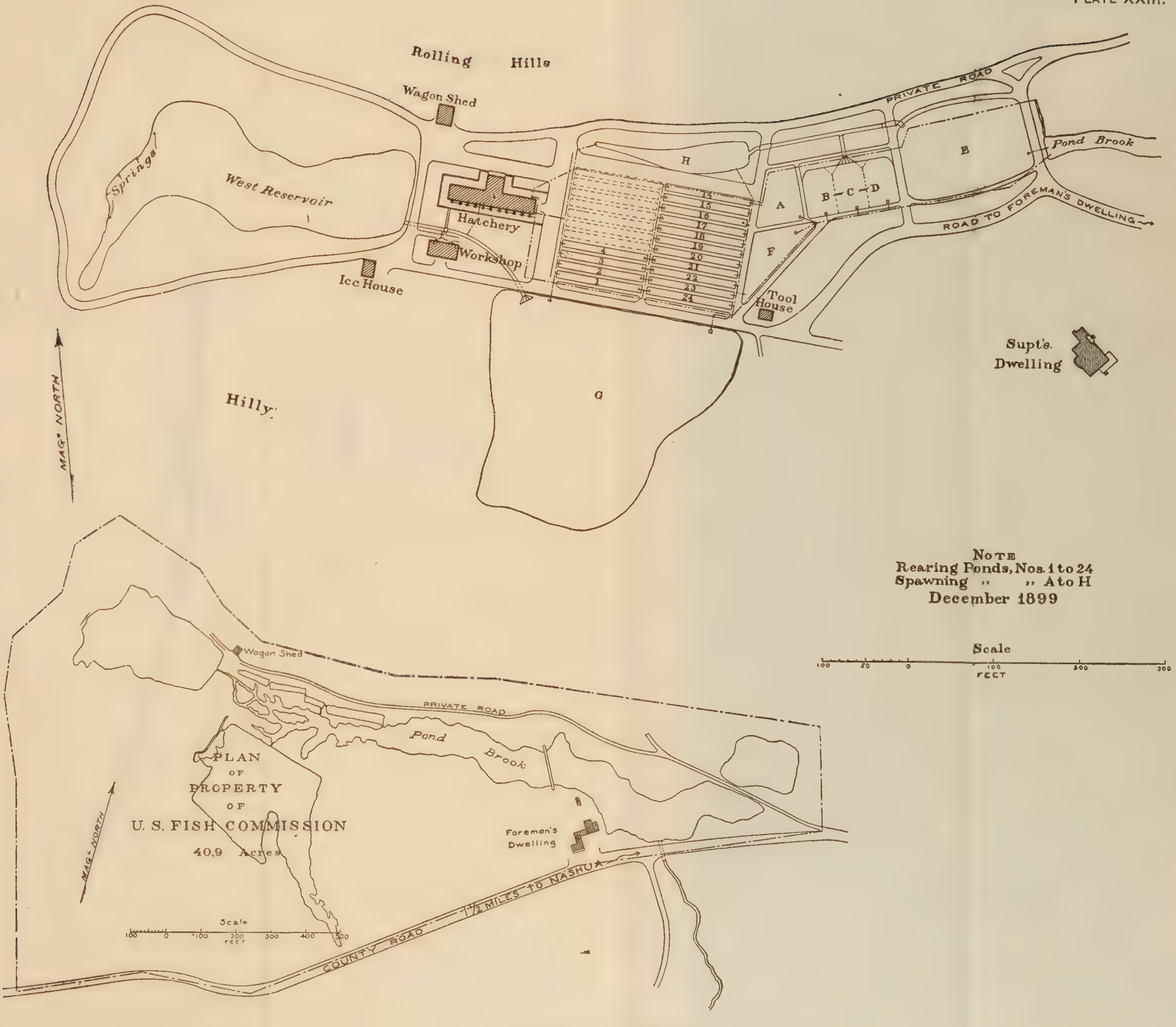
The work on the whole was disappointing. No rain fell during the season and but few salmon entered the creek, as the low water in the Sacramento River permitted spawning in the main stream at points which would not ordinarily be suitable. This is likely to be repeated every dry season. Reports from 30 miles down the river showed that salmon were spawning in many localities where they had never been seen before, and that the number entering all the creeks was small.

The methods employed in stripping and fertilizing the eggs were the same as heretofore. The force consisted of ten men, three of whom stripped the females, two the males, one looked out for the pans in which the eggs were taken and added water to the milt; two men were employed steadily in dipping females out of the pen and one the males. As heretofore, the eggs were taken in pans containing about half a pint of water each, instead of by the dry method, as at most of the other stations of the Commission. The milt and eggs were taken at the same time and stirred constantly to insure immediate fertilization. When thoroughly mixed the pan was filled with fresh water, placed on a shelf, and allowed to remain until seven or eight other pans had been similarly treated, after which they were all poured into a transportation can and sent to the hatchery, fresh water being added frequently to wash off the milt. If the eggs were still adhesive on arrival at the hatchery, fresh water was added until they separated, when they were distributed in baskets, 40,000 to each. As soon as the fish spawned they were thrown in a pen and afterwards turned over to people who came from far and near to lay in supplies for the winter.

At the beginning of the season threats were made that the rack would be blown up, hence an armed guard was placed on watch for a few nights, but no trouble was experienced. These threats were made by people living above the station on the creek, who wanted the salmon to ascend. Many carp were caught while hauling the seine and were turned over to the Chinese population, who prefer them to salmon or trout.

During the season a new stable was built, 26½ feet long by 11 feet wide and 8⅓ feet high, with slanting shake roof and sheds 16½ feet long and 11 feet wide at both ends for wagons. As considerable trouble was experienced with the water supply, from hogs and cattle, it became necessary to fence the ditch on both sides with barbed wire, the top and second strands being covered with board railings to prevent stock from being injured.

PLATE XXIII.


Rolling Hills
Wagon Shed
Springs
West Reservoir
Hatchery
Workshop
Ice House
PRIVATE ROAD
Pond Brook
ROAD TO FOREMAN'S DWELLING
H
A
B-C-D
E
F
G
1
2
3
4
13
15
16
17
18
19
20
21
22
23
24
Tool House
Supt's. Dwelling
Hilly
MAG. NORTH
NOTE
Rearing Ponds, Nos. 1 to 24
Spawning " " A to H
December 1899
Scale
100
50
0
100
200
300
FEET
Wagon Shed
PRIVATE ROAD
Pond Brook
PLAN OF PROPERTY OF U. S. FISH COMMISSION
40.9 Acres
MAG. NORTH
Foreman's Dwelling
1½ MILES TO NASHUA
COUNTY ROAD
Scale
100
0
100
200
300
400
500
FEET

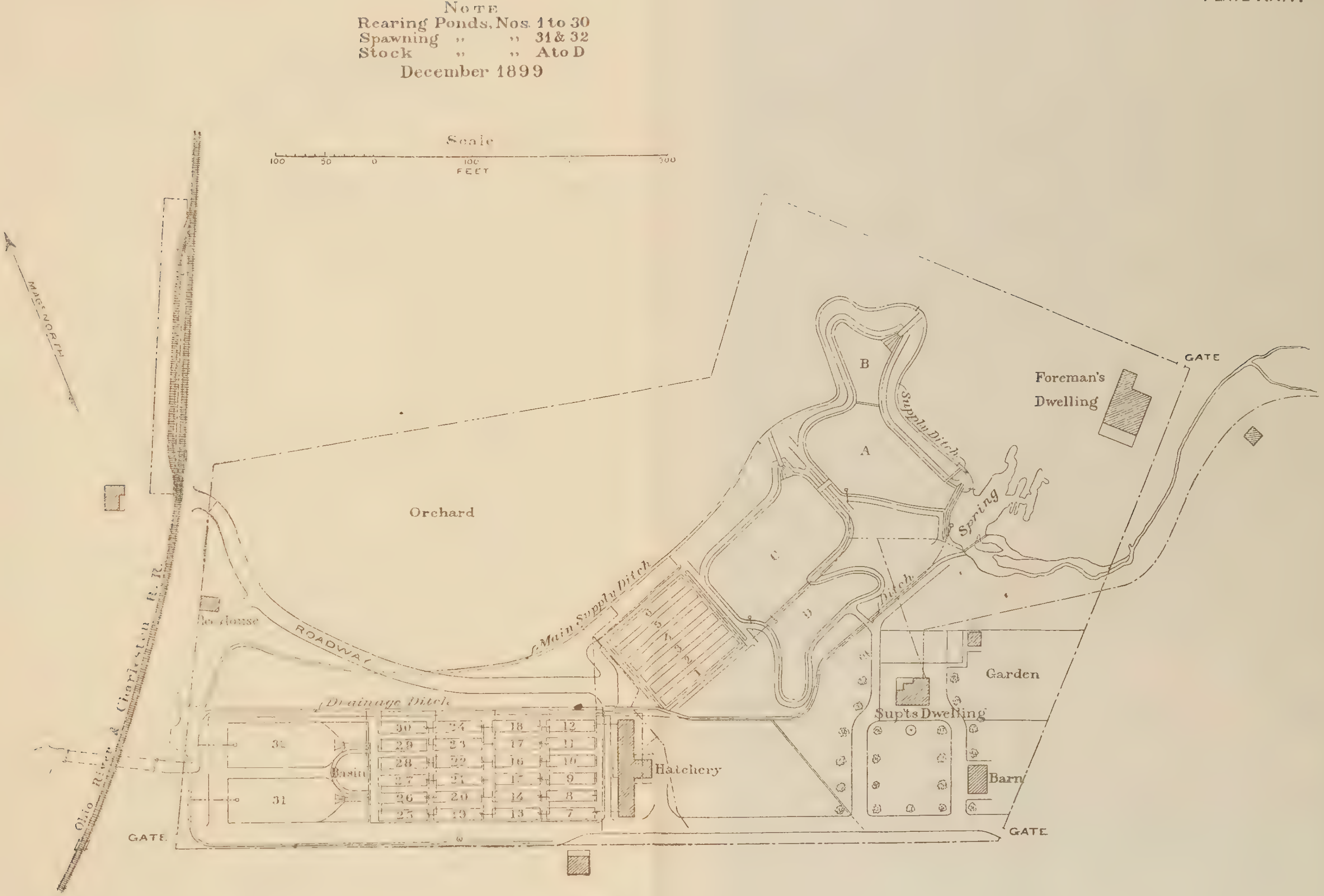
NASHUA STATION, NEW HAMPSHIRE.

l
t

k
n
p
a
o

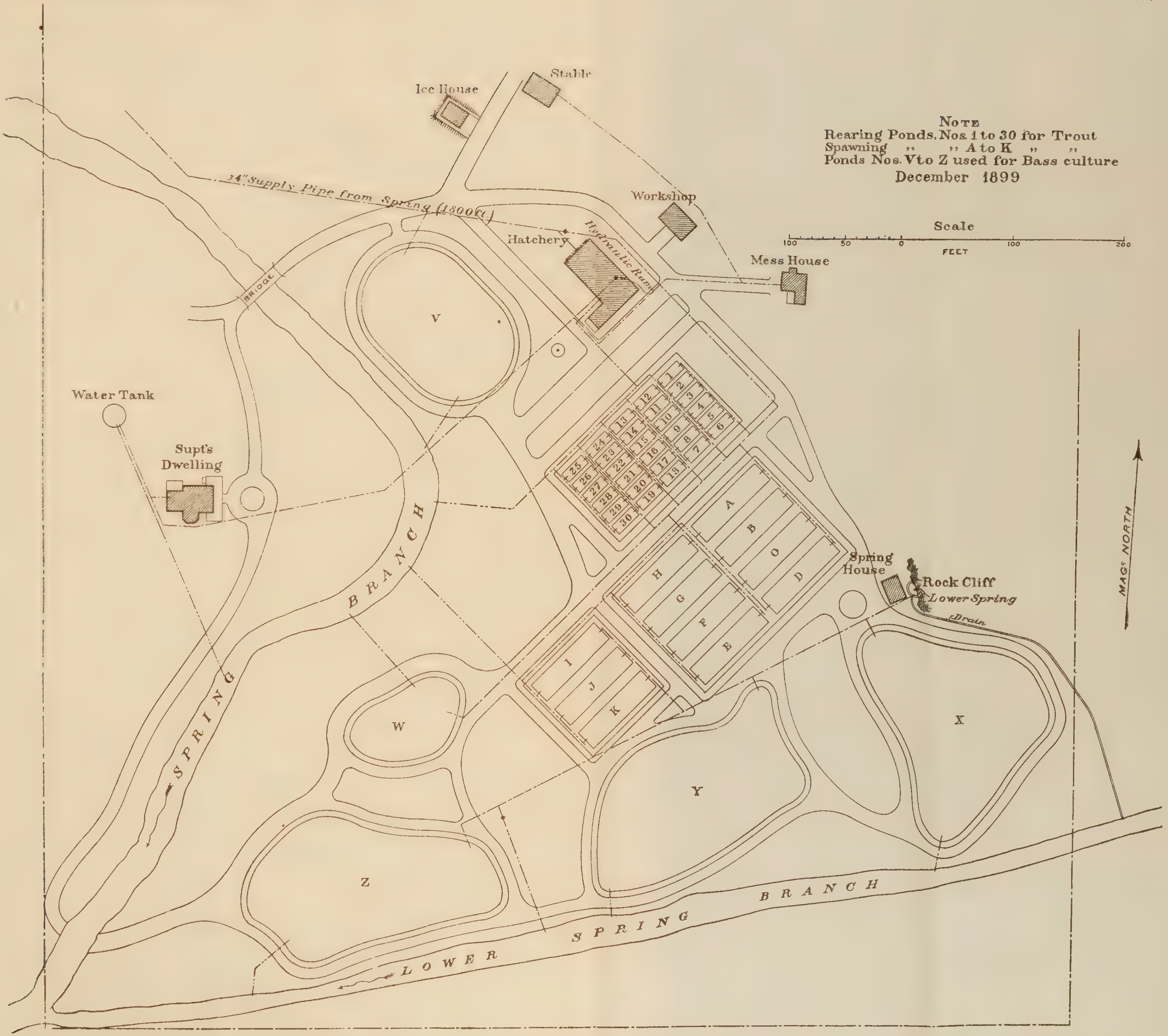
w
a
e
n
s
b

PLATE XXIV.


NOTE
Rearing Ponds, Nos. 1 to 30
Spawning " " 31 & 32
Stock " " A to D
December 1899
Scale
100
50
0
100
FEET
300
MAG. NORTH
Orchard
Ohio River & Charleston R. R.
Ice House
ROADWAY
Main Supply Ditch
Drainage Ditch
Basin
32
31
30
29
28
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Hatchery
GATE
B
A
C
D
Supply Ditch
Spring
Ditch
Foreman's Dwelling
GATE
Garden
Sup'ts Dwelling
Barn
GATE

ERWIN STATION, TENNESSEE.

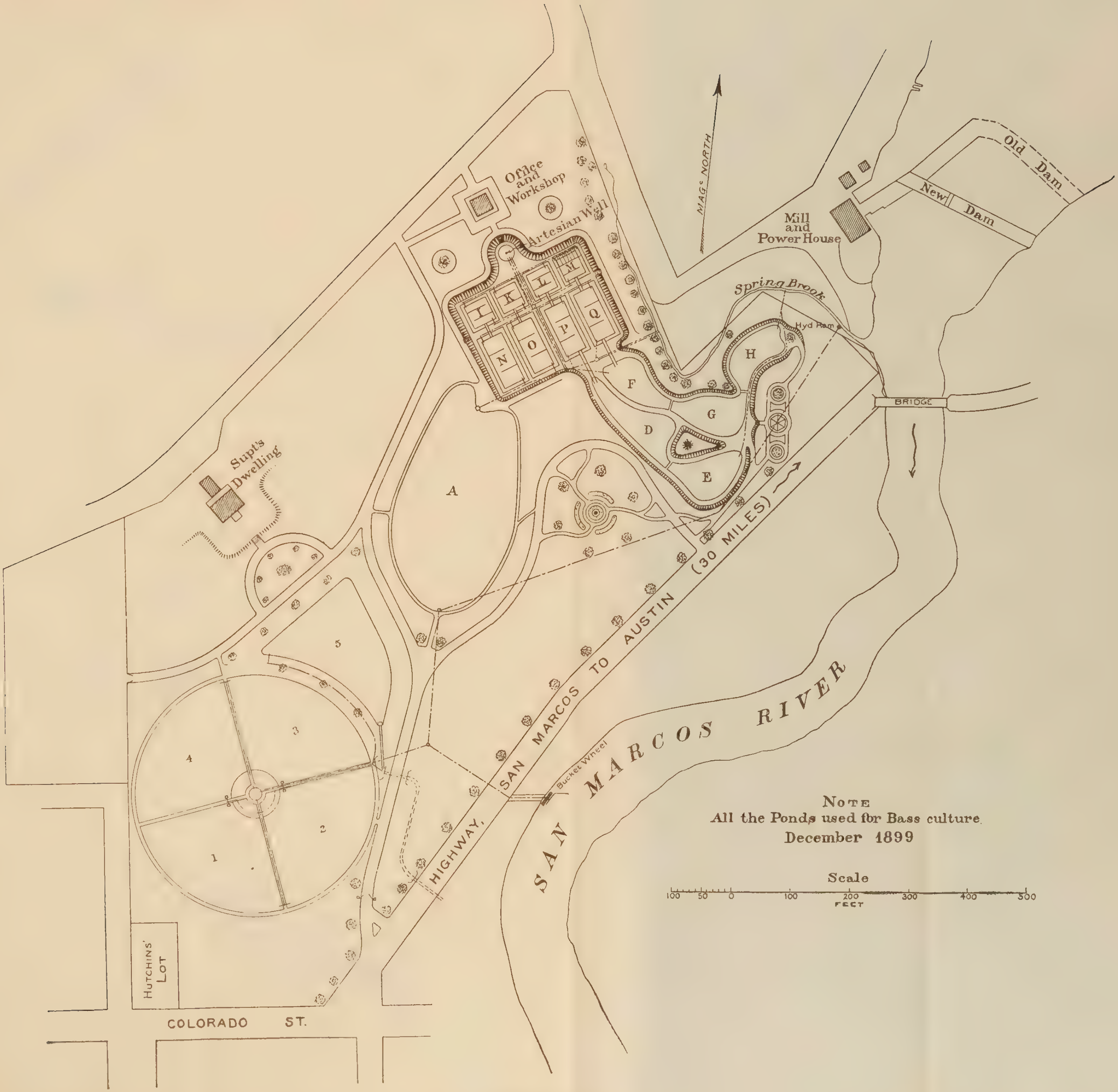
PLATE XXV.


Stable
Ice House
Note
Rearing Ponds, Nos. 1 to 30 for Trout
Spawning ,, ,, A to K ,, ,,
Ponds Nos. V to Z used for Bass culture
December 1899
14" Supply Pipe from Spring (1800 ft.)
Workshop
Hatchery
Hydraulic Ram
Scale
100
50
0
100
200
FEET
Mess House
Bridge
V
Water Tank
Supt's Dwelling
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
A
B
C
D
E
F
G
H
I
J
K
Spring House
Rock Cliff
Lower Spring
Drain
MAG. NORTH
SPRING BRANCH
W
X
Y
Z
LOWER SPRING BRANCH

MANCHESTER STATION, IOWA.

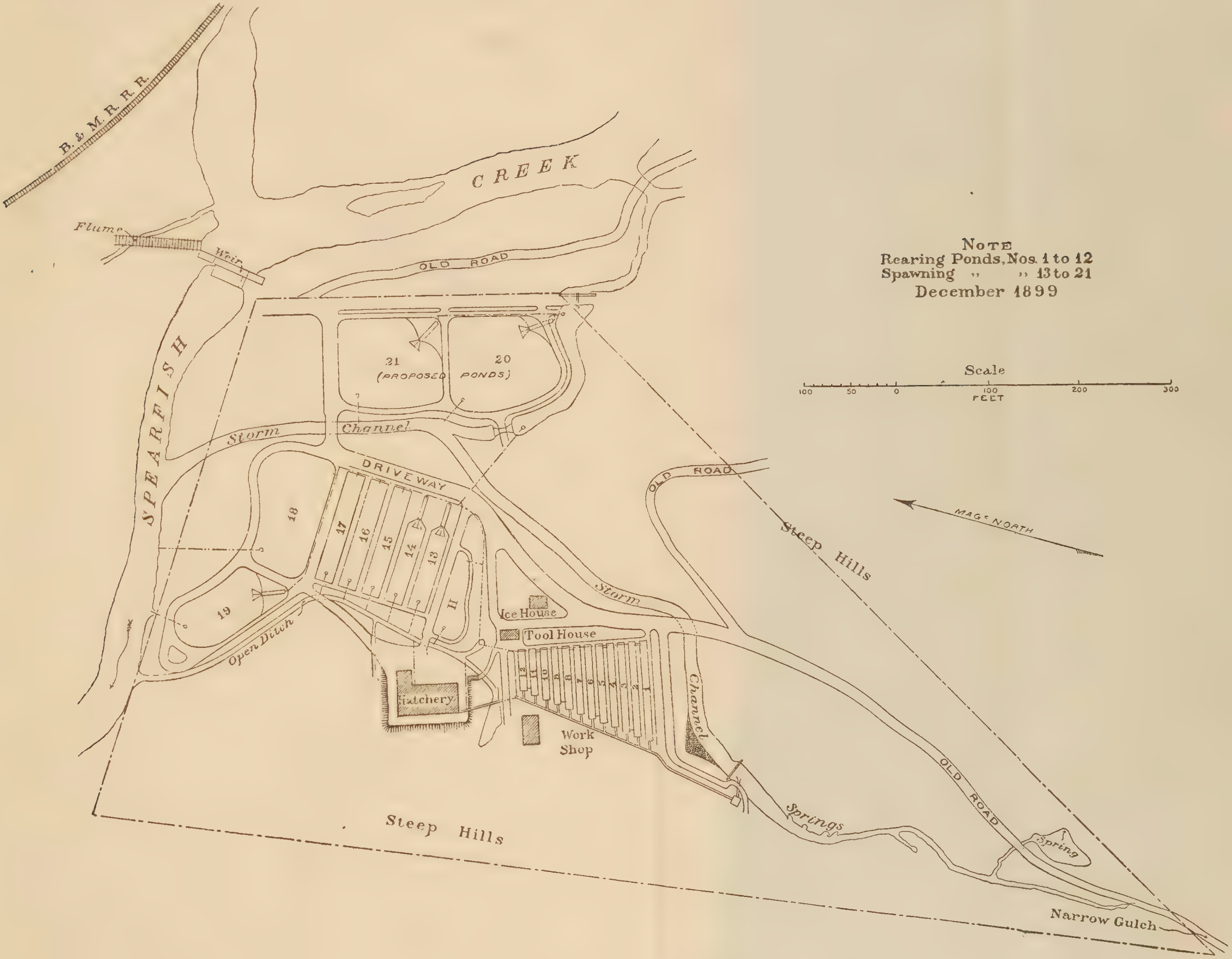
Report U. S. F. C. 1899. (To face page C.)

PLATE XXVI.


Office and Workshop
Artesian Well
Supt's Dwelling
MAG^c NORTH
Mill and Power House
Old Dam
New Dam
Spring Brook
Hyd Ram
BRIDGE
A
D
E
F
G
H
I
K
L
M
N
O
P
Q
1
2
3
4
5
HIGHWAY, SAN MARCOS TO AUSTIN (30 MILES)
SAN MARCOS RIVER
Bucket Wheel
HUTCHINS' LOT
COLORADO ST.
NOTE
All the Ponds used for Bass culture.
December 1899
Scale
100 50 0 100 200 300 400 500
FEET

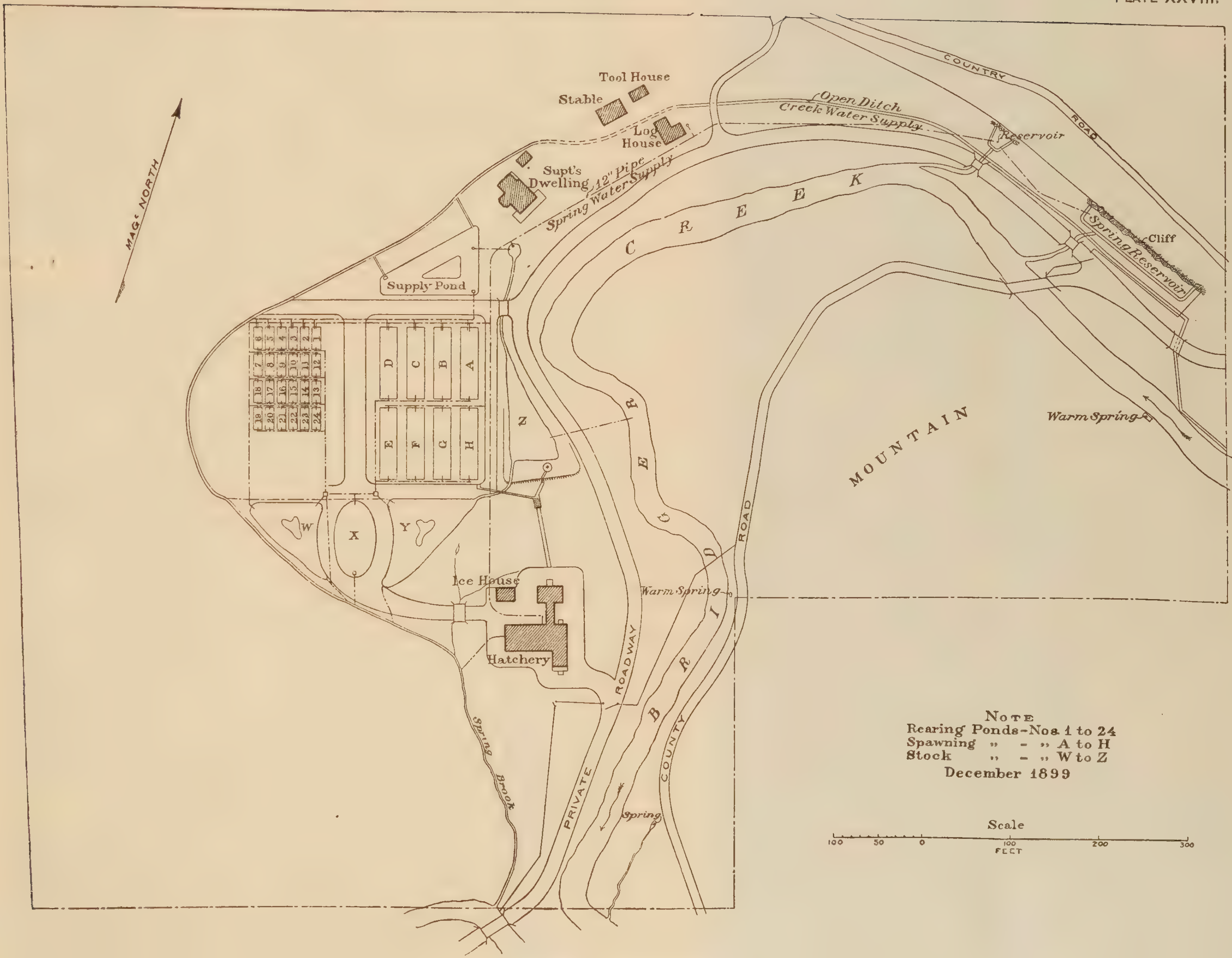
SAN MARCOS STATION, TEXAS.

PLATE XXVII.


B. & M. R. R. R.
Flume
Weir
CREEK
SPEARFISH
OLD ROAD
21 (PROPOSED PONDS)
20
Storm Channel
DRIVEWAY
18
17
16
15
14
13
11
19
Open Ditch
Storm
Ice House
Tool House
12 11 10 9 8 7 6 5 4 3 2 1
Hatchery
Work Shop
Channel
Springs
Spring
OLD ROAD
Steep Hills
Steep Hills
Narrow Gulch
MAG. NORTH
NOTE
Rearing Ponds, Nos. 1 to 12
Spawning " " 13 to 21
December 1899
Scale
100 50 0 100 200 300
FEET

SPEARFISH STATION, SOUTH DAKOTA.

PLATE XXVIII.


MAG: NORTH
Tool House
Stable
Log House
Supt's Dwelling
12" Pipe
Spring Water Supply
Open Ditch
Creek Water Supply
Reservoir
COUNTRY ROAD
CREEK
Cliff
Spring Reservoir
Supply Pond
1 2 3 4 5 6
7 8 9 10 11 12
13 14 15 16 17 18
19 20 21 22 23 24
A B C D
E F G H
Z
W X Y
Ice House
Hatchery
Warm Spring
BRIDGER CREEK
MOUNTAIN
Warm Spring
ROAD
PRIVATE ROADWAY
COUNTY ROAD
Spring Brook
Spring
NOTE
Rearing Ponds—Nos. 1 to 24
Spawning " — " A to H
Stock " — " W to Z
December 1899
Scale
100 50 0 100 200 300
FEET

BOZEMAN STATION, MONTANA.

Details of distribution.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Shad:			
Connecticut State Fish Commission, Joshuatown, Conn		9, 700, 000	
Blackbird Creek, Middletown, Del		120, 000	
Mount Pleasant, Del		300. 000	
Appoquirimink Creek, Middletown, Del		120, 000	
Mount Pleasant, Del		120, 000	
Smyrna Creek, Smyrna, Del		540, 000	
Leipsic Creek, Cheswold, Del		540, 000	
St. Johns Creek, Dover, Del		840, 000	
Murderkill Creek, Felton, Del		1, 140, 000	
Mispillion Creek, Milford, Del		780, 000	
Indian River, Millsboro, Del		2, 850, 000	
Wyoming, Del		360, 000	
Brandywine Creek, Wilmington, Del		15, 210, 000	
Potomac River, near Fish Lakes, D. C			3, 000, 000
Cannouchee River, Groveland, Ga		394. 833	
Chattahoochee River, Atlanta, Ga	1, 901, 000	28, 600	
Flint River, Albany, Ga		459, 000	
Potomac River, off Bryan Point, Md		1, 755, 000	
Broad Creek, Md		801, 000	
Piscataway Creek, Md		2, 797, 000	
Bar Landing, Md		1, 571, 000	
Point of Rocks, Md		800, 000	
Pamunkey Creek, Pamunkey Creek, Md		4, 462, 000	
Accokeek Creek, Accokeek Creek, Md		4, 116, 000	
Piscataway Creek, Piscataway Creek, Md		1, 189, 000	
Broad Creek, Broad Creek, Md		453, 000	
Chesapeake Bay, Havre de Grace, Md	10, 930, 000	53, 481, 000	
Spesutia Narrows, Md		1, 000, 000	
Swan Creek, Md		1, 250, 000	
Patuxent River, Laurel, Md		450, 000	
Patapsco River, Relay, Maryland		450. 000	
Bush River, Bush River Station, Md		1, 200, 000	
Susquehanna River, Garrett Island, Md		450. 000	
Port Deposit, Md		2, 900, 000	
Gunpowder River, Gunpowder Station, Md		950, 000	
Wicomico River, Salisbury, Md		900, 000	
Tuckahoe Creek, Queen Anne, Md		2, 550, 000	
Chester River, Chestertown, Md		900, 000	
St. Martin's River, Bishop, Md		300. 000	
Mill Creek, below Perryville, Md		1, 375, 000	
Wankinco River, Wareham, Mass		450, 000	
North River, Hanover, Mass		420, 000	
Delaware River, Gloucester, N. J	2, 200, 000	1, 000, 000	
Billingsport, N. J		4, 957, 000	
Lambertville, N. J		9, 461, 000	
Milford, N. J		2, 968, 000	
Toms River, South Lakewood, N. J		1, 000, 000	
Metedeconk River, Lakewood, N. J		1, 000, 000	
Menasquan River, Farmingdale, N. J		1, 000, 000	
Salem Creek, Salem, N. J		525, 000	
Hudson River, Catskill, N. Y		11, 470, 000	
Albemarle Sound, off Avoca, N. C		8, 130, 000	
off Edenton, N. C		903, 000	
Edenton Harbor, Edenton, N. C		3, 652, 000	
Perquimans River, Hertford, N. C		450, 000	
Neuse River, Goldsboro, N. C		684, 285	
Six Runs, near Warsaw, N. C		684, 285	
Tar River, Tarboro, N. C		684, 285	
Northeast Branch of Cape Fear River, Wallace, N. C		684, 285	
Pembroke Creek, Edenton, N. C		307, 000	
Pennsylvania State Fish Commission, Bristol, Pa	9, 265, 000		
Susquehanna River, Fites Eddy, Pa		7, 050, 000	
Columbia, Pa		6, 750, 000	
Peachbottom, Pa		3, 750, 000	
McCalls Ferry, Pa		3, 300, 000	
Delaware River, Lackawaxen, Pa		450, 000	
Delaware Water Gap, Pa		450, 000	
Pee Dee River, Pee Dee, S. C		394, 833	
Santee River, S. C		394, 833	
Santee Canal, Monk's Corner, S. C		394, 833	
Edisto River, Ponpon, S. C		394, 833	
Combahee River, Yemassee, S. C		394, 833	
Nansemond River, Suffolk, Va		425, 000	
Potomac River, Mount Vernon, Va		858, 000	
Occoquan Bay, Occoquan, Va		5, 180, 000	
Little Hunting Creek, below Alexandria, Va		1, 952, 000	
Dogue Creek, Dogue Creek, Va		3. 106, 000	
Pohick Creek, Pohick Creek, Va		2, 647, 000	
Craney Island Swash, Va		377, 000	
Total	24, 296, 000	208, 311, 740	3, 000, 000

NOTE.—2,700,000 fry were transferred from Central Station to the Fish Lakes rearing-ponds, and are not included in the above tabulation.

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Quinnat salmon:			
California Fish Commission, Sisson, Cal	13, 850, 500		
Eel River Hatchery	10, 042, 300		
Bear Valley Hatchery	1, 000, 000		
McCloud River, Baird, Cal	85, 200	3, 275, 110	
Salmon River, Salmon, Oreg		650, 355	
Clackamas River, Garfield, Oreg		2, 930, 000	
Stone, Oreg		4, 003. 961	
and Clear Creek, Stone, Oreg		3, 493, 870	
Oregon Fish Commission, Mapleton, Oreg	2, 002, 000		
Lake Morey, Fairlee, Vt			147
Tuscarora Creek, Leesburg, Va			12
Tate Run, Wytheville, Va			1, 230
Little White Salmon River, Chenowith, Wash		1, 791, 056	
Washington Fish Commission, Tacoma	500, 000		
Japanese Government, Niigata Ken, Japan	100, 000		
J. Williamson, St. Denis, France	25, 000		
L. F. Ayson, New Zealand	25, 000		
Total	27, 630, 000	16, 144, 352	1, 389
Atlantic salmon:			
Connecticut Fish Commission, Windsor Locks, Conn	200, 000		
Alamoosook Lake, Orland, Me			76, 465
Toddy Pond, Orland and Surry, Me			134, 900
Williams Pond, Bucksport, Me			12, 000
Long Pond, Bucksport, Me			6, 922
Hancock Pond, Bucksport, Me			2, 000
Brewer Pond Tributary, Bucksport, Me			8, 920
Penobscot River, Passadumkeag, Me		140, 000	85, 000
Mattawamkeag, Me		155, 000	65, 610
Lincoln Center, Me		150, 000	
Heart Pond, Orland, Me			440
Youghiogheny River, Swanton, Md		4, 225	
New Hampshire Fish Commission, Laconia, N. H	200, 000		
Pennsylvania Fish Commission Allentown, Pa	250, 000		
Tuscarora Creek, Leesburg, Va			95
Total	650, 000	449, 225	392, 352
Landlocked salmon:			
California Fish Commission, Sisson, Cal	20, 000		
Connecticut Fish Commission, Windsor Locks, Conn	25, 000		2, 000
Hayden Lake, Skowhegan, Me			1, 500
Lake George, Thorndike, Me			5, 000
Rangeley Lakes, Upton, Me			2, 000
Holbrook's Pond, Holden, Me			3, 500
Jim Pond, Carrebassett, Me			1, 500
Thompson's Pond, Oxford, Me			4, 000
Tea Pond, Carrebassett, Me			1, 500
Moose Pond, Hartland, Me			2, 000
Long Pond, Livermore, Me			1, 500
Kendall Pond, Livermore, Me			1, 500
Wood's Pond, Ellsworth, Me			2, 000
Sandy Creek, Unity, Me			1, 500
Moosehead Lake, Greenville, Me			3, 000
Blunt's Pond, Ellsworth, Me			2, 000
Donnell's Pond, Franklin, Me			4, 000
Lake Maranocook, Winthrop, Me			4, 000
Round Pound, Shirley, Me			3, 000
Dutton Pond, Ellsworth Falls, Me			2, 000
North Pond, Farmington, Me			2, 000
Half-Mile Pond, Great Pond, Me			4, 775
Cobbosseecontee Pond, Winthrop, Me			9, 500
Alligator Lake, Great Pond, Me			5, 000
Lake Anasagunticook, Canton, Me			2, 000
Bemis Brook, Bemis, Me			1, 000
Cupsuptic Brook, Bemis, Me			1, 000
King and Bartlett Lakes, Dead River, Me			2, 000
Branch Pond, Dedham, Me			51, 000
Green Lake, Otis, Me			176, 657
Heart Pond, Orland, Me			4, 606
Roach Pond, Greenville, Me			2, 000
Grand Lake Stream, Washington County, Me		141, 875	33, 000
Grand Lake, Washington County, Me			81, 171
Sebec Lake, Foxcroft, Me			2, 000
Long Pond, Bar Harbor, Me			1, 500
Canaan Lake, Rockland, Me			2, 500
China Lake, Waterville, Me			1, 000
Toddy Pond, Orland, Me			17, 794
Surry, Me			679
Tunks Pond Sullivan, Me			1, 000

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Landlocked salmon—Continued.			
Phillips Lake, Lakehouse, Me			4,000
Maine Fish Commission, Enfield, Me	42,500		
Parmacheue Club, Camp Caribou, Me	20,000		
Podunk Pond, Brookfield, Mass			2,000
Comet Lake, Worcester, Mass			1,000
William Lawrence, Worcester, Mass	5,000		
W. H. Drew, Plymouth, Mass	5,000		
Massachusetts Fish Commission, Sutton, Mass	10,000		
Crystal Lake, Enfield, N. H			2,000
Grafton Pond, Grafton, N. H			1,000
Lake Winnepesaukee, Laconia, N. H			2,000
Penacook and Webster Lakes, Concord, N. H			2,000
A. M. Bigelow, Branchville, N. J	5,000		
Paradox Lake, Ticonderoga, N. Y			2,000
Big Trout Lake, Horseshoe, N. Y			1,000
Calvin Lake, Horseshoe, N. Y			2,000
Trout Lake, St. Regis Falls, N. Y			1,000
Adirondack League Club Lake, Fulton Chain, N. Y			2,000
Lake George, Caldwell, N. Y			3,000
Lake Champlain, Fort Henry, N. Y			3,000
R. C. Alexander, Old Forge, N. Y	10,000		
J. Annin, jr., Caledonia, N. Y	15,000		
Rhode Island Fish Commission, Carolina, R. I	20,000		
James Sharpe, Salt Lake City, Utah	5,000		
Caspian Lake, Greensboro, Vt			7,977
Lake Dunmore, Brandon, Vt			1,600
Salisbury, Vt			2,993
Willoughby Lake, Westmore, Vt			5,619
Barton, Vt			1,000
Vermont Fish Commission, Roxbury, Vt	10,000		
Clyde River, Newport, Vt			1,000
Tuscarora Creek, Leesburg, Va			100
Total	192,500	141,875	497,971
Steelhead trout:			
Connecticut Fish Commission, Windsor Locks, Conn	21,000		
State Fish Commission, Bangor, Me			100
Alligator Lake, Great Pond, Me			1,000
Jordan Pond, Northeast Harbor, Me			500
Green Lake, Otis, Me			2,667
Heart Pond, Orland, Me			4,131
Craig Pond, Orland, Me			4,194
Alamoosook Lake, Orland, Me			4,218
Toddy Pond, Orland, Me			6,679
Surry, Me			6,706
Sweetwater and Bowman creeks, Lake County, Mich			2,500
Bitterroot River, Victor, Mont			9,996
Bell Creek Lake, Whitehall, Mont			5,000
Catlin's reservoir, Dorsey, Mont			4,999
Clear Creek, Stone, Oreg		8,625	
Lake Morey, Fairlee, Vt			1,620
Crystal Lake, Barton, Vt			2,000
Total	21,000	8,625	56,310
Loch Leven trout:			
Eagle River, Edwards, Colo			5,000
Upper Evergreen Lake, near Leadville, Colo			12,000
East Fork Chicago Creek, Idaho Springs, Colo		7,000	
Connecticut Fish Commission, Windsor Locks, Conn	8,500		
Pleasant Lake, Leslie, Mich			1,000
Strawberry Lake, Evart, Mich			1,000
Total	8,500	7,000	19,000
Rainbow trout:			
Big Nance Creek, Courtland, Ala			500
Spring Lake, Gadsden, Ala			500
Silver Lake, Seale, Ala			300
Tadlocks Lake, Seale, Ala			200
Applicants in Alabama			900
Spring Lake, Bryant, Ark			1,000
Spring Lake, Mammoth Springs, Ark			600
Illinois River, Siloam Springs, Ark			1,875
Rock Creek, Rust, Ark			1,400
Two-Mile Creek, Hatfield, Ark			1,400
Six-Mile Creek, Hatfield, Ark			1,400
Buffalo Creek, Cove, Ark			1,400
Barron Creek, Janssen, Ark			1,400
Rolling Fork Creek, Wickes, Ark			1,400

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Rainbow trout—Continued.			
West Fork of White River, Washington County, Ark			3,000
Frog Bayou, Mountainburg, Ark			3,000
Lancaster, Ark			3,000
Rudy, Ark			2,800
Whittington Park Lake, Hot Springs, Ark			1,000
Applicants in Arkansas			480
Connecticut Fish Commission, Windsor Locks, Conn	20,000		
Christiana Creek, Newark, Del			500
Spring Pond, Lanier Heights, D. C		3,000	
Sougue River, Clarksville, Ga			1,000
Mount Rest Lake, Stone Mountain, Ga			250
Mill Creek, Toccoa, Ga			500
State Fish Commission, Lagrange, Ga			600
Applicants in Georgia			450
Geo. W. Rea, Spencer, Idaho	10,000		
Black River, Sallisaw, Ind. T			1,875
Applicants in Indian Territory			1,300
Beaver Pond, Decorah, Iowa			500
Trout Run, Decorah, Iowa			5,000
Plum Creek, Earlville, Iowa			500
Volga River, Fayette, Iowa			2,000
Applicants in Iowa			500
Bear Creek, Edgewood, Iowa		5,000	
Maquoketa River, Forestville, Iowa		1,000	500
Honey Creek, Manchester, Iowa		5,000	
Spring Branch, Forestville, Iowa		4,009	
Applicants in Kansas			1,945
Swan Lake, Belfast, Me			2,000
Jordan Pond, Northeast Harbor, Me			500
Lake Pennesseewassei, Norway, Me			1,000
Canaan Lake, Camden, Me			2,000
Heart Pond, Orland, Me			2,000
Alamoosook Lake, Orland, Me			5,862
Craig Pond, Orland, Me			1,500
Toddy Pond, Orland, Me			2,395
Cherry Run, Woodbine, Md			300
Jacobs Run, Big Pool, Md			300
West Branch of Patapsco River, Henryton, Md			300
Bee Tree Creek, Parkton, Md			500
Stone Run, Rising Sun, Md			500
Laurel Brook, Fallston, Md			500
Walnut Springs, near Baltimore, Md			500
Little Seneca Creek, near Germantown, Md			300
State Fish Commission, Harrington and Deep creeks, Swanton, Md		5,143	1,500
State Fish Commission, Baltimore, Md	25,000		
Piscataway Creek, Meadows, Md			300
Applicants in Maryland			700
Long Pond, Worcester, Mass			1,000
Applicants in Massachusetts			1,000
Spring Brook, Oxford, Mich		1,000	
Boardman River, Traverse City, Mich		1,000	
Flemming Creek, Ypsilanti, Mich		1,000	
Stony Creek, Ypsilanti, Mich		1,000	
East Branch, Au Sable River, Grayling, Mich		3,000	
Ash Cave Lake, Dixon, Mo			1,000
Elm Spring, Cuba, Mo			500
Herrill Branch, Neosho, Mo			189
Cedar Gap Pond, Cedar Gap, Mo			2,400
Bryant Creek, Bryant, Mo			3,635
Mountain Grove Pond, Mountain Grove, Mo			2,000
Piney Creek, Piney Creek, Mo			1,875
Willow Grove Pond, Willow Springs, Mo			900
Cowskin River, Lanagan, Mo			1,850
Crane Creek, Neosho, Mo			2,000
Baker Creek, Dixon, Mo			1,875
Gasconade River, Gerome, Mo			2,500
Blue Spring, Bourbon, Mo			3,450
Hahatonka Lake, Hahatonka, Mo			1,250
Bennett Mill Spring, Bennett Mill, Mo			625
Saranac Spring, Leasburg, Mo			2,500
Indian Creek, Christopher, Mo			3,000
Elm Spring, Christopher, Mo			75
Applicants in Missouri			3,500
State Fish Commision, South Bend, Nebr			10,000
Granite Lake, Keene, N. H			500
State Fish Commission, Plymouth, N. H	20,000		
Percy's Summer Club, Percy, N. H	10,000		
Pequest Creek, Belvidere, N. J			500
Montilena Lake, Belvidere, N. J			800

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Rainbow trout—Continued.			
Spring Lake, Magdalena, N. Mex			965
Gallinas River, Las Vegas, N. Mex			1,930
Waterworks Reservoir, Raton, N. Mex			965
Hoosic River, Valley Falls, N. Y			500
Linville River, Cranberry, N. C			1,100
Sapphire and Fairfield Lakes, Sapphire, N. C			500
Stony Creek, Nashville, N. C			600
Flat Creek, Black Mountain, N. C			500
Reids Millpond, Reidsville, N. C			300
Caney Fork Creek, Sylva, N. C			400
Dicks Creek, Dillsboro, N. C			500
Junaluska Creek, Andrews, N. C			500
Hickerson Creek, Andrews, N. C			500
Poplar Hollow Creek, Mitchell County, N. C			250
Big Laurel Creek, Madison County, N. C			534
Applicants in North Carolina			700
Brushy Creek, Newark, Ohio		2,000	
Applicants in Ohio		1,000	
Medicine Bluff Creek, Fort Sill, Okla			880
Spring Lake, Enid, Okla			900
Applicants in Oklahoma			440
Trout Run, Norristown, Pa			500
Clover Creek, Williamsburg, Pa			598
Conodoquinett Creek, Chambersburg, Pa			700
Matthews Creek, Greers Depot, S. C			500
Rosehill Lake, Kollock, S. C			300
Spring Lake, Cleveland, Tenn			300
Adair Creek, Knoxville, Tenn			500
Whiteoak Creek, Clarksville, Tenn			474
Pinewood Lake, Clarksville, Tenn			500
Sinking Creek, Greenville, Tenn			500
Big Pigeon River, Newport, Tenn			1,000
Rock Creek, Unicoi County, Tenn			750
Granny Lewis Creek, Unicoi County, Tenn			600
Higgins Creek, Unicoi County, Tenn			1,500
Indian Creek, Blue Noll, Tenn			332
Middle Ford, Tenn			167
Baker Ford, Tenn			167
Garlands Ford, Tenn			167
Dicks Creek, Unicoi County, Tenn			467
Spivy Creek, Unicoi County, Tenn			1,016
Rocky Fork Creek, Unicoi County, Tenn			900
Martins Creek, Bonner's Mill, Tenn			300
North Indian Creek, Unicoi County, Tenn			600
Broad Shoal Creek, Unicoi County, Tenn			300
Devils Creek, Unicoi County, Tenn			149
Applicants in Tennessee			812
Texas			940
Beaver Pond, Proctor, Vt			3,000
Tinker Creek, Roanoke, Va			400
Tate Run, Wytheville, Va			460
Big Spring, Leesburg, Va			112
Applicants in Virginia			800
Youghiogheny River, Preston County, W. Va			300
Flowing Springs, Charlestown, W. Va			300
East River, Bluefield, W. Va			300
Quarry Run, Morgantown, W. Va			200
White Oak Run, Terra Alta, W. Va			300
Mill Creek, Alderson, W. Va			1,000
Meadow Creek, Ronceverte, W. Va			1,000
Laurel Run, Ronceverte, W. Va			500
Culvertson Creek, Ronceverte, W. Va			1,000
Howards Creek, White Sulphur Springs, W. Va			500
Blackwater River, Davis, W. Va			500
Little Best Lake, Gordon, Wis			1,500
Trout Brook, Elleva, Wis			1,000
Applicants in Wisconsin			1,000
S. E. Land, Laramie, Wyo	25,000		
Hon. Moreton Frewen, Innishannon, Ireland	10,000		
August Nobre, Villa do Conde, Portugal	10,000		
William Burgess & Co., Malvern Wells, England	10,000		
F. Dill, Heidelberg, Germany	10,000		
Directeur, Jardin Zoologique d'Acclimatation, Paris, France	25,000		
Total	175,000	33,143	158,831
Brook trout:			
Brush Creek, Eagle, Colo			15,000
Fryingpan River, Norrie, Colo			1,500
Clohesey Lake, Granite, Colo			7,500

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Brook trout—Continued.			
Peltons Lake, Montrose, Colo		3,000	7,500
Fryingpan River, Thomasville, Colo			1,500
Ruedi, Colo			7,500
Southey Lake, Montevista, Colo			7,500
Lime Creek, Eagle and Pitkin counties, Colo		6,667	7,500
South Fork of Platte River, Park County, Colo			7,500
Fryingpan River, Eagle and Pitkin counties, Colo		6,667	7,500
North Fork of Fryingpan River, Pitkin County, Colo		6,667	7,500
Spring Lake, Montevista, Colo			7,500
Lake Creek, near Twin Lakes, Colo			40,000
Upper Brush Creek, Eagle, Colo			500
Eagle River and tributaries, Wolcott, Colo			10,000
North Fork of South Platte River:			
Bailey		14,000	7,000
Estabrook		15,000	3,000
Crosson		3,000	3,000
Cliff		5,000	3,000
Pine Grove		2,000	4,000
Lake Creek, near Leadville			10,000
Upper Evergreen Lake, near Leadville			18,000
Lake Devereux, Aspen, Colo			10,000
Silver Creek, Shirley, Colo		5,000	4,400
West Marshall Creek, Chester, Colo			1,300
Tomiche River, Mounds, Colo			4,200
Gunnison, Colo			4,100
Applicants in Colorado		20,000	5,300
Platte River, Alma, Colo		5,000	
Vendome Fish Ponds, Salida, Colo		5,000	
Mountain Lake, Montevista, Colo		5,000	
Lake Lenore, Ouray, Colo		5,000	
Hell Gate Creek, Pitkin County, Colo		6,667	
Last Chance Creek, Pitkin County, Colo		6,666	
Savage Lakes, Pitkin County, Colo		6,666	
Francisco Creek Lake, Del Norte, Colo		5,000	
Little Brothers Lake, Wolcott, Colo		5,000	
Johnson Park Lake, Cimarron, Colo		5,000	
Grand View Lake, Slaghts, Colo		5,000	
Lake San Cristobal, Lake City, Colo		10,000	
Blue River, Breckenridge, Colo		5,000	
Range and Boulder lakes, Blackhawk, Colo		5,000	
Craig Creek, Estabrook, Colo		6,000	
Platte River, Grant, Colo		15,000	
Geneva Creek, Grant, Colo		11,000	
Crystal River, Carbondale, Colo		5,000	
Naylor Lake, Georgetown, Colo		10,000	
North Fork of South Platte River, Slaghts, Colo		5,000	
South Arkansas River, Buenavista, Colo		10,000	
Big and Little Cimarron rivers, Cimarron, Colo		10,000	
Cache la Poudre River, Fort Collins, Colo		15,000	
Spring Lakes, Cimarron, Colo		5,000	
Big Thompson River, Loveland, Colo		10,000	
Deer Creek, Cliff, Colo		5,000	
North Fork of South Platte River, Buffalo, Colo		15,000	
Buffalo Creek, Buffalo, Colo		5,000	
Buckhorn Creek, Loveland, Colo		5,000	
Cook Creek, Slaghts, Colo		5,000	
Paine Creek, Slaghts, Colo		5,000	
North Platte River, Florrissant, Colo		5,000	
Derrys Ponds, near Leadville, Colo		5,000	
Lake Pittman, near Leadville, Colo		3,000	
South Platte River, Deansbury, Colo		5,000	
Lake Peterson, Fort Collins, Colo		10,000	
South Fork of Chicago Creek, Idaho Springs, Colo		10,000	
Deer Creek, Bailey, Colo		5,000	
Soda Creek, Idaho Springs, Colo		5,000	
Chicago Lakes, Idaho Springs, Colo		5,000	
East Fork of Chicago Creek, Idaho Springs, Colo		10,000	
South Platte River, Florrissant, Colo		5,000	
Fall River, Idaho Springs, Colo		5,000	
Mountain Lake, Buenavista, Colo		5,000	
Elk Creek, Pine Grove, Colo		5,000	
North Fork of South Arkansas River, Salida, Colo		10,000	
Trout and Wigwam creeks, South Platte, Colo		5,000	
White Earth Creek, Lake City, Colo		5,000	
Grand Lake, Empire, Colo		20,000	
South Clear Creek, Georgetown, Colo		10,000	
Snake and Willow creeks, Dillon, Colo		10,000	
North Fork Lake, Salida, Colo		3,000	
North Fork of South Platte River, South Platte, Colo		5,000	
Cottonwood Creek, Buenavista, Colo		5,000	

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Brook trout—Continued.			
Alder Creek, Alder, Colo		5,000	
South Beaver Creek, Gunnison, Colo		5,000	
Elk Creek, Sapinero, Colo		10,000	
Eagle Creek, Gunnison, Colo		5,000	
Mammoth and Boulder creeks, Central City, Colo		10,000	
Sylvan Brook, New Haven, Conn		8,000	
Spring Brook, Torrington, Conn		9,980	
Cold Spring Brook, Wilton, Conn		4,000	
Stony Brook, Wilton, Conn		4,000	
Morehouse Brook, South Norwalk, Conn		4,000	
Spring Brook, Chatham, Conn		9,995	
Neck River, Madison, Conn		8,000	
Applicants in Connecticut			1,500
Connecticut Fish Commission, Windsor Locks, Conn	25,000		
Cascade Branch, Warm Springs, Ga		4,000	
Waha Lake, Lewiston, Idaho			4,000
Potache River, Vollmer, Idaho			4,000
Bean and Lick creeks, Weiser, Idaho			4,000
Lower Fish Lakes, Rathdrum, Idaho			4,000
Big Lost and Wood rivers, Hailey, Idaho			6,000
Silver Creek, Hailey, Idaho		9,000	
Big Lost River, Ketchum, Idaho		9,000	
Applicants in Idaho		4,500	3,000
George W. Rea, Spencer, Idaho	20,000		
Spring Lake, Warsaw, Ill			200
Rough and Ready Creek, Westville, Ind		10,000	
Frames Creek, Westville, Ind		2,000	
Bowman Creek, South Bend, Ind		10,000	
Applicants in Indiana		2,500	
Bear Creek, Edgewood, Iowa			6,700
Cooley Creek, Lansing, Iowa			5,000
Bacon Creek, Lansing, Iowa			5,000
Fetketter Creek, Lansing, Iowa			5,000
Clear Creek, Lansing, Iowa			5,000
Roggensack Creek, Lansing, Iowa			2,000
Badger Creek, Decorah, Iowa			5,000
Bloody Run, McGregor, Iowa		8,484	5,000
Mill Creek, Bellevue, Iowa			3,000
Elk and Pine creeks, Elkport, Iowa			3,000
Spring Branch, Manchester, Iowa		15,000	6,500
Maquoketa River, Forestville, Iowa		10,000	1,700
Applicants in Iowa		5,000	400
Pond and Stream, Osage, Iowa		8,484	
Canoe Creek, Decorah, Iowa		8,484	
Baldwin Creek, Cresco, Iowa		4,242	
Bigall Creek, Cresco, Iowa		4,242	
Daley Pond, Cresco, Iowa		4,242	
Snymagill Creek, McGregor, Iowa		8,484	
Spring Brook, McGregor, Iowa		8,484	
Mink Creek, Wadena, Iowa		8,484	
Maquoketa River, Manchester, Iowa		15,000	
Parlin Pond, Jackman, Me		24,000	
Pierce Pond, Bingham, Me		15,000	
Green Lake, Otis, Me		20,000	8,800
Donnell Pond, Franklin, Me		5,000	
Varnum Pond, Farmington, Me		10,000	
Cobbosseecontee Pond, Augusta, Me		5,000	
Lake Anasagunticook, Canton, Me		5,000	
Eagle Lake, Bar Harbor, Me		5,000	
Canaan Lake, Camden, Me		12,000	
Leach Brook, Oakland, Me		5,000	
Bear Pond, Shirley, Me		10,000	
Embden Lake, North Anson, Me		10,000	
Flanders and Tunk ponds, Sullivan, Me		5,000	
Reservoir, City Water Company, Belfast, Me		5,000	
Clearwater Pond, Farmington, Me		5,000	
Parmachene Lake, Camp Caribou, Me		10,000	
Moosehead Lake, Greenville Junction, Me		5,000	
Blacks Pond, Ellsworth, Me		5,000	
Long Pond, Bar Harbor, Me		5,000	
Moosehorn Lake, Calais, Me		5,000	
Pattens Pond, Ellsworth, Me		15,000	
Branch Pond, Dedham, Me		10,000	
Applicants in Maryland		4,000	400
Hunting Creek, Thurmont, Md			700
Spring Brook, Lowell, Mass		25,000	
Fox Brook, Blackstone, Mass		5,000	
Dunklins Hole, Dedham, Mass		3,988	
Powessett Pond, Dedham, Mass		7,980	
Morris Creek, Spring Lake, Mich			500

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Brook trout—Continued.			
Grand River, Cedarbank, Mich			500
Duck Creek, Muskegon, Mich			600
South Branch Tobacco Creek, Clare, Mich			400
Silver Creek, Clare, Mich			400
Middle Branch Tobacco Creek, Clare, Mich			400
Harriam Brook, Schoolcraft, Mich			400
Brandywine and Moosic creeks, Niles, Mich			400
Reyneys Creek, Marquette, Mich		10,000	
Hill Creek, Sidnaw, Mich		10,000	
Millers Creek, Greenville, Mich		10,000	
Clear Creek, Greenville, Mich		5,000	
Bayers and Stony creeks, Gustin, Mich		20,000	
Myers Creek, Cheboygan, Mich		10,000	
Spring Creek, Oxford, Mich		10,000	
South and Middle Forks Tobacco River, Farwell, Mich		7,000	
Upper Cedar River, Mancelona, Mich		10,000	
Rapid River, Rugg, Mich		10,000	
Tributary of Grand River, Hanover, Mich		10,000	
Silver and Gold creeks, East Tawas, Mich		50,000	
Spring Brook, Richland Junction, Mich		20,000	
Little Manistee River, Canfield, Mich		25,000	
Fellow and Merritt creeks, Hudson, Mich		10,000	
Silver Creek and Tuttle Ditch, Oscoda, Mich		30,000	
Bear Creek, Manistee Crossing, Mich		25,000	
Sanborn Creek, Nirvana, Mich		5,000	
Blood and Baldwin creeks, Baldwin, Mich		10,000	
Bowman and Dannaher creeks, Wingleton, Mich		20,000	
Sweetwater Creek, Stearns, Mich		9,860	
Weldon Creek, Branch, Mich		9,820	
Pine River, Harrisville, Mich		25,000	
Au Sable River, Grayling, Mich		125,000	
East Branch Au Sable River, Grayling, Mich		37,000	
Graham Creek, Farwell, Mich		4,850	
Huffmire and Twin creeks, Evart, Mich		6,855	
Middle Branch of Pere Marquette River, Nirvana, Mich		4,852	
Manistee River, Baldwin, Mich		9,840	
Kinney Creek, Wingleton, Mich		14,500	
Branch of Pere Marquette River, Baldwin, Mich		4,000	
Bowman and Clear creeks, Wingleton, Mich		5,000	
Washington River, Washington Harbor, Mich		8,000	
Applicants in Michigan		500	
Spring Brooks, Northfield, Minn		25,452	5,000
Little Trout Brook, Lamoille, Minn		16,975	
Pleasant Valley Creek, Winona, Minn		16,975	
Blackhoof River, Atkinson, Minn		10,000	
Poplar River, Grand Marais, Minn		5,000	
Tischer Creek, Duluth, Minn		9,308	
Knife River, St. Louis County, Minn		5,000	
French River, St. Louis County, Minn		5,000	
A. Lauth, Fanning, Mo	3,000		
Spring Creek, Leadboro, Mont			2,000
North Fork of Sun River, Craig, Mont			1,950
Bitterroot River, Victor, Mont			2,994
Lake Agnes, Browns Station, Mont			4,980
Fork and Hensley creeks, Leadbore, Mont			4,975
Box Elder Creek, Havre, Mont			2,000
J. F. Comee, Missoula, Mont	5,000		
Walnut Creek, Nebraska City, Nebr			
Penacook Lake, Concord, N. H		2,000	500
Wild Meadow Brook, Grafton, N. H		8,000	225
State Fish Commission, Laconia, N. H	25,000		
Musconetcong Creek, Washington, N. J			
Pequest Creek, Belvidere, N. J			600
Trout Brook, Newark, N. J			300
A. M. Bigelow, Branchville, N. J	20,000		500
Horse and Cow Brooks, Far Hills, N. J			
Kaaterskill Creek, Catskill, N. Y			500
Schenevus Creek, East Worcester, N. Y		15,000	
Page Brook Creek, West Wintield, N. Y		20,000	
Oriskany Creek, Waterville, N. Y		10,000	
Big Brook, Adams Center, N. Y		15,000	
East Branch of Unadilla River, West Winfield, N. Y		10,000	
Elk Creek, Schenevus, N. Y		10,000	
West Oneonta Creek, Oneonta, N. Y		10,000	
Geddes Lake, Syracuse, N. Y		10,000	
Montfredy Brook, Syracuse, N. Y		10,000	
Carpenter Brook, Syracuse, N. Y		15,000	
Fullers Creek, Adams Center, N. Y		10,000	
Chenango River, Deruyter, N. Y		5,000	
Ragged Lake, Owlshead, N. Y		15,000	
		10,000	

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Brook trout—Continued.			
Budlong and Moyer Creeks, Frankfort, N. Y		10, 000	
Canister River, Hornellsville, N. Y		10, 000	
Canandaway Creek, Leona, N. Y		5, 000	
Applicants in New York		5, 000	
P. H. Flynn, Livingston Manor, N. Y	20, 000		
Adirondack League Club, Old Forge, N. Y	25, 000		
R. F. Carson, Sapphire, N. C	20, 000		
Spring Lake, Minot, N. Dak		10, 000	
Applicants in North Dakota		5, 000	
Brushy Fork Creek, Newark, Ohio		10, 000	
Spring Lake, Dayton, Ohio		9, 000	
West Liberty, Ohio		5, 000	
Reservoir, Mantan, Ohio		10, 000	
Applicants in Ohio		45, 000	
Youngs River, Portland, Oreg			5, 000
State Fish Commission, Portland, Oreg			6, 000
Mix Run, Driftwood, Pa			399
Trout Run, Shippensburg, Pa			900
State Fish Commission, Allentown, Pa	10, 000		
Beaver Creek, Buffalo Gap, S. Dak			3, 000
St. Mary Lake, Rosebud, S. Dak			1, 500
Branch of Spearfish Creek, Englewood, S. Dak			3, 000
Ross Spring, Crown Hill, S. Dak			750
Horse Creek, Hill City, S. Dak		10, 000	1, 500
Castle Creek, Hill City, S. Dak			1, 500
Harney Peak Lake, Hill City, S. Dak			1, 500
Sylvan Lake, Custer, S. Dak			1, 500
Applicants in South Dakota			3, 000
Big Coolee Creek, Wilmot, S. Dak		10, 000	
West Fork of Potato Creek, Pine Ridge Reservation, S. Dak		10, 000	
Rapid Creek, Rapid City, S. Dak		10, 000	
Whitewood Creek, Englewood, S. Dak		10, 000	
Granny Lewis Creek, Unicoi County, Tenn			350
Higgins Creek, Unicoi County, Tenn			475
Broad Shoal Creek, Unicoi County, Tenn			50
Devil Creek, Unicoi County, Tenn			125
Red Butte Creek, near Salt Lake City, Utah		9, 000	
Applicants in Utah		2, 000	
F. M. Lyman, jr., Salt Lake City, Utah	25, 000		
J. H. Tuck, Salt Lake City, Utah	5, 000		
Spring Brook, Rutland, Vt			500
Bigfish Pond, Sutton, Vt			500
Caspian Lake, Greensboro, Vt		40, 000	2, 800
Mount Tabor Brook, Danby, Vt		20, 000	
Wells River, Wells River, Vt		16, 000	
Pico Pond and Brooks, Rutland, Vt		99, 975	
Holland Pond, Holland, Vt		8, 000	
Frog Pond and Brooks, St. Johnsbury, Vt		10, 000	
Caledonia Trout Club Pond, St. Johnsbury, Vt		15, 000	
Mud Pond and Brook, Randolph, Vt		5, 000	
Tributaries of Deerfield River, Wilmington, Vt		7, 997	
Kendall Brook, Bondville, Vt		4, 900	
Lake Mitchell, Sharon, Vt		40, 000	
Tributaries of Sleeper River, St. Johnsbury, Vt		30, 000	
Fairbanks Pond, St. Johnsbury, Vt		5, 000	
Darling Pond, Groton, Vt		40, 000	
Vermont State Fish Commission, Colebrook, N. H	25, 000		
Big Spring, Leesburg, Va			10
Spring Brook, Yakima, Wash			1, 000
Rock Creek, Winona, Wash			3, 500
Clear Lake, New Whatcom, Wash			2, 500
Lake Cushman, Tacoma, Wash			2, 500
Spokane River, Spokane, Wash			1, 500
Wilbur Creek, Wilbur, Wash			3, 000
Columbia River, Wenatchee, Wash			1, 500
Little Spokane River, Sciota, Wash			1, 500
Quarry Run, Morgantown, W. Va			400
Meadow Creek, Ronceverte, W. Va			500
A. G. Buller, Cheat Bridge, W. Va	20, 000		
Middle Inlet, Wausaukee, Wis		10, 000	
Springstead Brook, Lac du Flambeau, Wis		10, 000	
Klemm Creek and Pond, Medford, Wis		8, 484	
Thompson and Otter creeks, Augusta, Wis		8, 484	
State Fish Commission, Laramie, Wyo	50, 000		
Hon. Moreton Frewen, Innishannon, Ireland	20, 000		
William Burgess & Co., Malvern Wells, England	20, 000		
Total	338, 000	2, 354, 200	388, 583

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Black-spotted trout:			
Rainbow Lake, Gunnison, Colo			1,000
Eagle River and tributaries, Wolcott, Colo			10,000
Mountain streams in the vicinity of Central City, Colo			15,000
North Fork of South Platte River:			
Buffalo, Colo			6,000
Park Siding, Colo			3,000
Dawson, Colo			3,000
Dome Rock, Colo			3,000
Tennessee Creek, near Leadville, Colo			10,000
Tomiche River, Mounds, Colo			5,000
Gunnison, Colo			5,000
Denver & Rio Grande R. R. Co. Lake, Granite, Colo			2,000
Henry Lake, Idaho		50,000	
Applicants in Idaho			2,000
Rocky Pond, Otis, Me		8,386	
Sage Creek, Chester, Mont			5,000
Smith River and tributaries, Dorsey, Mont			4,997
Sixteen-Mile Creek, Dorsey, Mont			4,990
Prairie Grove Lake, Toston, Mont			2,000
Lake Agnes, Brown Station, Mont			4,980
Cherry Creek, Bozeman, Mont			5,000
Crandall Creek, Bozeman, Mont			5,000
Cowan Reservoir, Box Elder, Mont			5,000
Big Elk and Lebo creeks, Leadboro, Mont			4,975
Deep Creek, Townsend, Mont			2,000
Spring Branch, Livingston, Mont			5,000
Catlin Reservoir, Dorsey, Mont			4,999
Applicants in Montana			4,000
Vincent Ponds, Anaconda, Mont		56,325	
J. H. Sharp, Fish and Game Warden, Salt Lake City, Utah			11,000
Clear Lake, New Whatcom, Wash			1,500
State Fish Commission, Laramie, Wyoming	25,000		
S. Jaffe, Osnabruck, Germany	10,000		
Total	35,000	114,711	135,441
Lake trout:			
California Fish Commission, Sisson, Cal	50,000		
Lake Koppin, Cimarron, Colo		10,000	
Connecticut Fish Commission, Windsor Locks, Conn	200,000		
Partridge Lake, South Bend, Ind		20,000	
Spirit Lake, Spirit Lake, Iowa		106,800	
Lake Okoboji, Spirit Lake, Iowa		53,800	
Lost Island Lake, Ruthven, Iowa		10,000	
Silver Lake, Lake Park, Iowa		10,000	
Maquoketa River, Manchester, Iowa			400
Donnell Pond, Franklin, Me		15,000	
Lake Tompson, Oxford, Me		15,000	
Sand Pond, Farmington, Me		15,000	
Branch Pond, Dedham, Me		45,000	
Rocky Pond, Dedham, Me		45,000	
Phillips Lake, Dedham, Me		45,000	
Holbrook Pond, Holden, Me		45,000	
Little Fitz Pond, Holden, Me		30,000	
Tunk Pond, Sullivan, Me		45,000	
Green Lake, Otis, Me		34,317	
Patten Pond, Ellsworth, Me		45,000	
State Fish Commission, Enfield, Me	500,000		
Lake Brown, Swanton, Md		11,128	
Garrot Pond, Hyannis, Mass		19,000	
Round Lake, Cedar Bank, Mich			10,000
Lake Huron, Alpena, Mich		1,050,000	33,000
Cheboygan, Mich		350,000	15,000
East Tawas, Mich			33,000
Lake Superior, Grand Marais, Mich			30,000
Lake Michigan, Manistique, Mich		350,000	15,000
Charlevoix, Mich		700,000	15,000
Crooked Lake, Clare County, Mich			15,000
Straits of Mackinac, Mackinaw City, Mich			9,000
Ste. Marie River, Sault Ste. Marie, Mich		350,000	
Round Lake, Hanover, Mich		20,000	
RawsonLake, Schoolcraft, Mich		20,000	
Lake Superior, Ontonagon, Mich		620,000	
Long Point, Isle Royale		240,000	
Wright Island, Isle Royale		120,000	
Washington Harbor, Isle Royale		120,000	
Tobin Harbor, Isle Royale		120,000	
Rock Harbor, Isle Royale		120,000	
Cod Harbor, Mich		120,000	
Fish Island, Mich		120,000	
Houghton, Mich		240,000	

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Lake trout—Continued.			
Lake Superior, Grand Portage, Minn		240, 000	
Chicago Bay, Minn		240, 000	
Grand Marais, Minn		240, 000	
Poplar River, Minn		240, 000	
French River, Minn		120, 000	
Two Harbors, Minn		120, 000	
Beaver Bay, Minn		240, 000	
Duluth, Minn		30, 000	
Otsego Lake, Cooperstown, N. Y		25, 000	
Lake Ontario, Cape Vincent, N. Y		200, 000	
Lake Ontario, off Grenadier Island, N. Y		200, 000	
Adirondack League Club, Fulton Chain, N. Y	100, 000		
Spring Lake, Minot, N. Dak		10, 000	
Devils Lake, Devils Lake, N. Dak		17, 000	
Big Stone Lake, Wilmot, S. Dak		25, 000	
Lake Kampeska, Watertown, S. Dak		33, 000	
Crystal Lake, Barton, Vt		15, 000	
Vermont State Fish Commission, Roxbury, Vt	300, 000		
Lake Michigan, Sheboygan, Wis			15, 000
Lake Superior, Bayfield, Wis		240, 000	
Sand Island, Wis		240, 000	
Bark Point, Wis		240, 000	
Port Arthur, Ontario, Canada		240, 000	
Total	1, 150, 000	8, 235, 045	190, 400
Scotch sea trout:			
Heart Pond, Orland, Me			742
Alamoosook Lake, Orland, Me			22
Tuscarora Creek, Leesburg, Va			50
Total			814
Golden trout:			
Phillips Lake, Dedham, Me		1, 500	
Green Lake, Otis, Me		1, 574	
Total		3, 074	
Grayling:			
Eagle River, Wolcott, Colo		5, 000	
Rio Grande River, Wagonwheel Gap, Colo		5, 000	
Platte River, Grant, Colo		5, 000	
Fryingpan River, Norrie, Colo		5, 000	
Spring Branch, Manchester, Iowa		10, 000	
Bear Creek, Edgewood, Iowa		6, 000	
Spring Creek, Forestville, Iowa		6, 000	
AuSable River, Grayling, Mich		25, 000	
Pere Marquette River, Baldwin, Mich		25, 000	
Bridger Creek, Bozeman, Mont		500, 000	
Elk Creek, Red Rock, Mont		3, 000, 000	
Elk Lake, Red Rock, Mont		100, 000	
Picnic Springs Creek, Red Rock, Mont		800, 000	
Hidden Lake, Red Rock, Mont		75, 000	
State Fish Commission, Carolina, R. I	50, 000		
State Fish Commission, Laramie, Wyo	25, 000		
Total	75, 000	4, 567, 000	
White-fish:			
Lake Erie, Monroe, Mich		18, 070, 000	
Lake Michigan, Beaver Island, Mich		3, 000, 000	
High Rollway, Mich		3, 000, 000	
Lake Superior, Ontonagon, Mich		2, 000, 000	
Grace Harbor, Mich		2, 000, 000	
Isle Royale, Mich		2, 000, 000	
White-fish Point, Mich		1, 900, 000	
Fisherman's Home, Mich		1, 300, 000	
Lake Huron, North Point, Mich		3, 500, 000	
South Point, Mich		3, 000, 000	
Can Buoy, Mich		1, 000, 000	
Thunder Bay Island, Mich		2, 500, 000	
Scarecrow Island, Mich		2, 000, 000	
Sugar Island, Mich		2, 000, 000	
North Fishing Ground, Mich		2, 000, 000	
Straits of Mackinac, at St. Ignace, Mich		3, 000, 000	
Antoine Lake, Iron Mountain, Mich		1, 000, 000	
New Hampshire Fish Commission, Ashland, N. H	216, 000		
Lake Ontario, Grenadier Island, N. Y		5, 000, 000	
Lake Erie, Niagara Reef, Port Clinton, Ohio		5, 040, 000	
North Bass Island Reef, Put-in-Bay, Ohio		9, 360, 000	
Peach Point Reef, Put-in-Bay, Ohio		15, 920, 000	
Buckeye Island Reef, Put-in Bay, Ohio		5, 950, 000	
Middle Bass Island Reef, Put-in Bay, Ohio		5, 100, 000	
Port Clinton, Ohio		9, 960, 000	

Details of distribution—Continued.

Species and disposition.	Eggs.	Fry and fingerlings.	Adults and yearlings.
White-fish—Continued.			
Lake Erie, Rattlesnake Island Reef, Put-in Bay, Ohio		9, 000, 000	
Toledo, Ohio		5, 950, 000	
Ottawa City, Ohio		4, 200, 000	
Ballast Island Reef, Put-in Bay, Ohio		3, 850, 000	
Green Island Reef, Put-in Bay, Ohio		6, 450, 000	
Starve Island Reef, Put-in Bay, Ohio		1, 600, 000	
Light-house Point Reef, Put-in Bay, Ohio		2, 880, 000	
East Side, Put-in Bay, Ohio		1, 600, 000	
Inland Lake, White, S. Dak		125, 000	
Lake Superior, Iron River, Wis		2, 000, 000	
Port Wing, Wis		2, 000, 000	
Raspberry Bay, Wis		2, 000, 000	
Lake Superior, Port Arthur, Ontario, Canada		1, 500, 000	
New Zealand Fish Commission, New Zealand	500, 000		
Total	716, 000	152, 755, 000	
Pike perch.			
Sogna Lake, Rolling Prairie, Ind		2, 000, 000	
Indian Lake, Kendallville, Ind		1, 000, 000	
Sackrider Lake, Kendallville, Ind		500, 000	
Eagle Lake, Warsaw, Ind		1, 000, 000	
Sylvan Lake, Rome City, Ind		1, 000, 000	
Pleasant and Long lakes, Waterloo, Ind		1, 000, 000	
Devils Lake, near Addison, Mich		500, 000	
Hanlon Lake, near Ludington, Mich		1, 000, 000	
Lake Erie, near Monroe, Mich		13, 200, 000	
Saginaw Bay, Saginaw Bay, Mich		7, 500, 000	
Thunder Bay, Alpena, Mich		4, 000, 000	
Devils Lake, Lenawee County, Mich		500, 000	
Sand Lake, Lenawee County, Mich		500, 000	
Diamond Lake, Cass County, Mich		1, 000, 000	
Indian Lake, Cass County, Mich		500, 000	
Fisher Lake, St. Joseph County, Mich		500, 000	
Duck Lake, Calhoun County, Mich		500, 000	
McIntosh Lake, Barry County, Mich		500, 000	
Round Lake, Barry County, Mich		500, 000	
Long Lake, Barry County, Mich		500, 000	
Pleasant Lake, Jackson County, Mich		500, 000	
Hunton Lake, Ingham County, Mich		500, 000	
Douglass Lake, Cheboygan County, Mich		1, 000, 000	
Crooked Lake, Emmet County, Mich		1, 000, 000	
Pickerel Lake, Emmet County, Mich		1, 000, 000	
Round Lake, Emmet County, Mich		500, 000	
Pencil Lake, Antrim County, Mich		500, 000	
Lost Lake, Antrim County, Mich		500, 000	
Sand Lake, Antrim County, Mich		500, 000	
Stoneledge Lake, Wexford County, Mich		1, 000, 000	
Susquehanna River, East Windsor, N. Y		1, 000, 000	
Raquette River, Potsdam, N. Y		1, 000, 000	
Lake Ontario, Wilsons Bay, N. Y		2, 000, 000	
St. Lawrence River, Cape Vincent, N. Y		3, 000, 000	
Lake Erie, Rattlesnake Island Reef, Put-in Bay, Ohio		32, 840, 000	
Peach Point Reef, Put-in Bay, Ohio		15, 000, 000	
Ballast Island Reef, Put-in Bay, Ohio		23, 160, 000	
North Bass Island Reef, Put-in Bay, Ohio		13, 800, 000	
Green Island Reef, Put-in Bay, Ohio		13, 800, 000	
Wehrles Point Reef, Put-in Bay, Ohio		12, 000, 000	
Port Clinton, Ohio		13, 800, 000	
Toledo, Ohio		1, 000, 000	
Sugar Island Reef, Put-in Bay, Ohio		14, 400, 000	
Honey Point Reef, Put-in Bay, Ohio		13, 200, 000	
Starve Island Reef, Put-in Bay, Ohio		13, 200, 000	
Put-in Bay, East Side Island, Ohio		11, 040, 000	
Kelly Island, Ohio		1, 600, 000	
Joes Pond, West Danville, Vt		200, 000	
Silver Lake, Barnard, Vt		50, 000	
Missisquoi River, Orleans County, Vt		1, 000, 000	
Lamoille River, Cambridge, Vt		1, 050, 000	
Total		232, 840, 000	
Yellow perch:			
Potomac River, Bathing Beach, D. C		30, 000	
Cat-fish:			
Chicago, Burlington and Quincy R. R. Pond, Galesburg, Ill			1, 000
Gages Lake, Grays Lake, Ill			250
Total			1, 250

Details of distribution—Continued.

Species and disposition.	Adults and yearlings.
Black bass:	
Ewings Millpond, Gadsden, Ala	100
Spring Creek, Calera, Ala	100
Black Creek, Gadsden, Ala	100
Cahaba River, Birmingham, Ala	200
Mulberry Creek, Bangor, Ala	100
Oxford Lake, Oxford, Ala	100
Mill Pond, Benton, Ala	75
Blackwater Creek, Jasper, Ala	150
East Lake, Birmingham, Ala	100
Sandy Creek, Waverley, Ala	175
Buck Creek Millpond, Dadeville, Ala	250
Hoster Creek, Columbia, Ala	75
Pond and Stream, Oneonta, Ala	100
Barren Fork of Flint River, Keys Mills, Ala	200
Mill Creek Pond, Piedmont, Ala	50
Spring Lake, Pike Road, Ala	200
Sandy Creek, Gold Hill, Ala	175
Green Lake, Demopolis, Ala	150
Mill Creek, Thomasville, Ala	100
Applicants in Alabama	1,230
Oak Creek, Jerome, Ariz	150
Big Lake, Big Lake, Ark	240
Spring Lake, Sulphur Springs, Ark	100
Dawdy Lake, Benton, Ark	240
Clear Springs, Antoine, Ark	100
Spirit Lake, Garland City, Ark	240
Applicants in Arkansas	710
Rocky Mountain Lake, Denver, Colo	300
Lake Wauconda, Larkspur, Colo	100
Lone Tree Lake, Greeley, Colo	100
Browns Lake, Sterling, Colo	50
Reservoir, Higganum, Conn	200
Paper Mill Pond, Seymour, Conn	200
D. C. Riggs Pond, Seymour, Conn	100
Washburns Pond, Seymour, Conn	200
Sawmill Pond, Seymour, Conn	100
Applicants in Connecticut	150
Wyoming Lake, Wyoming, Del	100
White Clay Creek, Newark, Del	200
E. G. Shortlidge, Wilmington, Del	300
Lake Denman, Atlanta, Ga	55
East Lake, Atlanta, Ga	100
Lake Clarameer, Atlanta, Ga	55
Spring Lake, Tunnel Hill, Ga	275
Ocklawilla Lake, Newnan, Ga	55
Spring Lake, Stinson, Ga	55
Brier Creek, Waynesboro, Ga	100
Middle Oconee River, Athens, Ga	100
Wildwood Lake, Columbus, Ga	55
Lake Fairoaks, Atlanta, Ga	85
Lake Killarney, Augusta, Ga	100
Millpond, Cuthbert, Ga	55
Little Cedar Millpond, Rome, Ga	100
Sealys Pond, Cuthbert, Ga	55
Muckalee Creek, Americus, Ga	100
Mobley Lake, Rome, Ga	55
Mill Pond, Graves Station, Ga	100
Flint River, Albany, Ga	196
Beaver Creek, Zenith, Ga	100
Tallapoosa River, Carrollton, Ga	100
Nail Creek Millpond, Baldwin, Ga	100
Butlers Millpond, Cuthbert, Ga	55
Cemetery Ponds, Macon, Ga	110
Maddox Millpond, Dalton, Ga	55
St. Elmo Lake, Columbus, Ga	55
Clemmons Millpond, Summerville, Ga	55
Shropshire Millpond, Summerville, Ga	100
Pearl Springs Lake, Newnan, Ga	55
Lake Ormwood, Atlanta, Ga	55
Spring Lake, Stone Mountain, Ga	100
Applicants in Georgia	2,620
Reservoir, Orchard, Idaho	150
Applicants in Idaho	414
Shermans Ponds, Ringwood, Ill	300
Channel Lake, Antioch, Ill	500
Lake Purington, Galesburg, Ill	200
Spring Lake, Washington, Ill	100
Black bass—Continued.	
Willards Pond, Harristown, Ill	3,500
Bement Pond, Bement, Ill	1,500
Gage Lake, Grayslake, Ill	1,135
Chicago, Burlington & Quincy R. R. Ponds, Galesburg, Ill	75
Highland Park Lake, Galesburg, Ill	570
Applicants in Illinois	200
Lake James, Angola, Ind	500
Elkhart River, Wawasee, Ind	500
Spring Lake, Covington, Ind	515
Sylvan Lake, Rome City, Ind	300
Spring Lake, Indianapolis, Ind	200
Laughery Creek, Batesville, Ind	200
Sweeney Lake, New Albany, Ind	75
Sogna Lake, Rolling Prairie, Ind	300
Wabash and Eel rivers, Logansport, Ind	200
Kane Lake, Rome City, Ind	100
Spring Lake, Fort Wayne, Ind	75
Tippecanoe River, Lafayette, Ind	200
Twin Lakes, Plymouth, Ind	300
Cedar Pond, Auburn Junction, Ind	150
Big Indian Creek, Mott, Ind	100
Wildcat Creek, Windfall, Ind	75
Lake Maxinkuckee, Culver, Ind	800
Sugar Creek, Crawfordsville, Ind	150
White River, Noblesville, Ind	150
Applicants in Indiana	1,625
Long Lake, Porteau, Ind. T	135
Spring Lake, Durant, Ind. T	125
Applicants in Indian Territory	325
Spitzuoggle Lake, Wapello, Iowa	500
West Okoboji Lake, Okoboji, Iowa	500
Wilson Lake, Harlan, Iowa	100
Middle River, Winterset, Iowa	800
Spring Ponds, Winterset, Iowa	400
Little Cedar River, Osage, Iowa	190
Upper Iowa River, Chester, Iowa	275
Lime Springs, Iowa	275
Clear Lake, Clear Lake, Iowa	500
Big Cedar River, Orchard, Iowa	190
Des Moines River, Estherville, Iowa	500
Pool of Siloam, Massena, Iowa	238
East Okoboji Lake, Okoboji, Iowa	500
Little Cedar River, Staceyville, Iowa	190
Iowa River, Iowa City, Iowa	500
Cedar River, Cedar Rapids, Iowa	4,000
Applicants in Iowa	1,062
Walnut River, Winfield, Kans	100
Crescent Lake, Valley Falls, Kans	50
Spring Pond, Hutchinson, Kans	200
Eureka Lake, Manhattan, Kans	100
Deep Creek, Manhattan, Kans	100
Lakeside Lake, Olathe, Kans	100
Tuttle Creek, Manhattan, Kans	100
Applicants in Kansas	961
Cumberland R., Cumberland Falls, Ky	200
Lake Isham, View, Ky	75
Plum Bottom Lake, Pembroke, Ky	50
Alexander Creek, Chamelion Springs, Ky	75
East Fork Little River, Hopkinsville, Ky	100
Spring Lake, Lexington, Ky	75
Kinnikinnick River, Vanceburg, Ky	200
Paradise Lake, Paducah, Ky	50
Walnut Flat Ice Pond, Stanford, Ky	75
Eden Hill Pond, Paducah, Ky	50
East Side Lake, St. Charles, Ky	100
Applicants in Kentucky	2,015
Deer Creek, Gilbert, La	125
Grand Cote Lake, Cypremont, La	200
Spring Lake, Cypremont, La	200
Homer, La	118
Sodus, La	120
Tangipahoa River, Ponchatoula, La	325
Inland Lake, Jeanerette, La	200
Greenwood Lake, Shreveport, La	1,000

Details of distribution—Continued.

Species and disposition.	Adults and yearlings.
Black bass—Continued.	
Applicants in Louisiana	1,954
Georges Run, Hampstead, Md	200
Patuxent River, Laurel, Md	200
Potomac River, Woodmont, Md	1,200
Youghiogheny River, Swanton, Md	1,000
State Fish Commission, Druid Hill Park, Md	10
Applicants in Maryland	100
Horn Pond, Woburn, Mass	150
Connecticut River, Holyoke, Mass	200
Willows Pond, Bristol, Mass	50
Lawrence Pond, West Barnstable, Mass	700
Spring Pond, Shelburne, Mass	150
Lake Huron, Alpena, Mich	350
Rush Lake, Kinde, Mich	200
Round Lake, Hanover, Mich	350
Murray Lake, Ypsilanti, Mich	200
Cheboygan River, Cheboygan, Mich	200
Twin Lakes, Grayling, Mich	200
Pleasant Lake, Leslie, Mich	200
Strawberry Lake, Evart, Mich	200
Asylum Lake, Kalamazoo, Mich	300
Lake Minnewaska, Glenwood, Minn	500
Split Rock River, Jasper, Minn	300
Meeler Lake, Aberdeen, Miss	100
Horseshoe Lake, Aberdeen, Miss	300
College Pond, Agricultural College, Miss	100
Marshal Lake, Columbus, Miss	300
Dead River, Aberdeen, Miss	300
Mill Pond, Newton, Miss	300
Lake City Waterworks Pond, Meridian, Miss	300
Swan Lake, Shuqualak, Miss	200
Spring Lake, Macon, Miss	300
Millpond, Shuqualak, Miss	100
Park Lake, Tupelo, Miss	300
Applicants in Mississippi	1,870
Big and Little Piney Creeks, Rolla, Mo	200
Park Lake, Carrollton, Mo	100
Spring Lake, Labelle, Mo	200
Cut-off Lake, Brunswick, Mo	200
Spring City Lake, Joplin, Mo	200
Herrells Spring Branch, Neosho, Mo	5,000
Applicants in Missouri	950
Lodge Pole Creek Lake, Sidney, Nebr	200
Spring Lake, Rushville, Nebr	50
Applicants in Nebraska	100
Franklin Lake, Crystal Lake, N. J	150
Stafford Lake, Manahawken, N. J	150
Echo Lake, Echo Lake, N. J	150
Green Run, Newfoundland, N. J	200
Oakford Lake, New Egypt, N. J	100
Quick Pond, Swartzwood, N. J	150
Silver Lake, Burlington, N. J	150
Lake Pohatcong, Tuckerton, N. J	150
Woods Upper Millpond, Quinton, N. J	300
Deal Lake, Asbury Park, N. J	200
Lake Carasaljo, Lakewood, N. J	200
Silver Lake, Lucaston, N. J	150
Applicants in New Jersey	200
Spring Lake, Watrous, N. Mex	150
Kroewing Lake, Las Vegas, N. Mex	100
Applicants in New Mexico	350
Reservoir, West Point, N. Y	150
Swago Lake, Callicoon, N. Y	200
Bolton Pond, Caldwell, N. Y	130
Potague Lake, Ramapo, N. Y	200
Newcomes Lake, Valley Falls, N. Y	100
Applicants in New York	600
Mallets Pond, Fayetteville, N. C	75
Cross Creek, Fayetteville, N. C	450
Lake Henry, Gates, N. C	100
Haw River Millpond, Burlington, N. C	150
Dan and Mayo rivers, Reidsville, N. C	150
Rockfish Creek, Fayetteville, N. C	75
Stony Creek, Burlington, N. C	100
Black bass—Continued.	
Little Alamance Creek, Burlington, N. C	100
Buttermilk Creek, Burlington, N. C	100
Big Falls Pond, Burlington, N. C	100
Glencoe Pond, Burlington, N. C	100
Jackotts Creek, Spray, N. C	75
Cotton Millpond, Kings Mountain, N. C	75
Elkin Creek, Elkin, N. C	75
Reems Creek, Alexander, N. C	75
Long Swamp, Fayetteville, N. C	75
Ewens Creek, Pine Hall, N. C	75
Fairfield Lake, Sapphire, N. C	75
Peachtree Creek, Raleigh, N. C	75
Cape Fear River, Fayetteville, N. C	150
Beaver Lake, Fayetteville, N. C	150
Ledge of Rocks Creek, Stem, N. C	50
Applicants in North Carolina	925
Scioto and Brush creeks, McCullogh Station, Ohio	400
Walhonding River, Warsaw, Ohio	300
Rogers Lake, Chesterville, Ohio	200
Little Miami River, Milford, Ohio	300
Tuscarawas River, Zoar, Ohio	200
Scioto River, Delaware, Ohio	600
Prospect, Ohio	200
Huron River, Shelby Junction, Ohio	200
Lake Eli, Oakley, Ohio	100
White Water River, Simonsons, Ohio	500
Springfield Lake, Akron, Ohio	300
Odells Lake, Lakeville, Ohio	200
West Fork of Mill Creek, Wyoming, Ohio	200
Millpond, Sardinia, Ohio	75
Applicants in Ohio	1,850
Cheadle Creek, Guthrie, Okla	150
Little Lakes, Manchester, Okla	75
Crystal Springs, Pond Creek, Okla	50
Applicants in Oklahoma Territory	925
Susquehanna River, Selin Grove, Pa	50
Susquehanna River, Susquehanna, Pa	75
Spring Lake, Roaring Springs, Pa	50
Wyoming Creek, Reading, Pa	50
Cartright Lake, East Stroudsburg, Pa	60
Conococheague Cr., Greencastle, Pa	100
Tahooka Lake, Preston Park, Pa	100
Codorus Creek, Emigsville, Pa	60
Big Conewago Creek, Emigsville, Pa	65
Conedogwinit Creek, Carlisle, Pa	100
Beech Lake, Honesdale, Pa	100
Park Creek Lake, Penllyn, Pa	67
Juniata River, Altoona, Pa	50
Ice Pond, Penllyn, Pa	33
Shawanese Lake, Outlet Station, Pa	50
Roaring River, Altoona, Pa	50
Schuylkill River, Birdsboro, Pa	50
Clarion River, Ridgway, Pa	50
City Reservoir, Washington, Pa	25
Oakford Lake, Jeannette, Pa	25
Conestoga Creek, Lancaster, Pa	100
West Branch of Brandywine Creek, Modena, Pa	50
Saylor's Lake, Bethlehem, Pa	50
Lake Grinnell, Bethlehem, Pa	50
Mountain Lake, Troy, Pa	75
Schuylkill River, Norristown, Pa	50
Allegheny River, Thompson, Pa	75
Susquehanna River, Halls, Pa	125
French Creek, St. Peter, Pa	50
Susquehanna River, Mehoopany, Pa	50
Indian Creek, Macungie, Pa	55
Water Co. Reservoir, Altoona, Pa	50
Forest Lake, East Stroudsburg, Pa	60
Penryn Lake, Penryn, Pa	25
Simms Lake, Masthope, Pa	200
Weighters Lake, Thompson, Pa	200
Applicants in Pennsylvania	200
State Fish Comm., Westerly, R. I	500

Details of distribution—Continued.

Species and disposition.	Adults and yearlings.
Black bass—Continued.	
Crowders Creek, Clay Hill, S. C	75
Spring Lake, Waterloo, S. C	50
Congaree Creek, Congaree, S. C	200
Hard Labor Creek, Greenwood, S. C	100
Seneca River, Anderson, S. C	100
Owens Millpond, Bennettsville, S. C	200
Headwaters Saluda River, Laurens, S. C	100
North Edisto River, Lightwood, S. C	150
South Edisto River, Whaleys, S. C	150
Applicants in South Carolina	650
Lake Edgemont. Edgemont, S. Dak	100
Lake Chilhomer. Dover, S. Dak	300
Artesian Lake, Chamberlain, S. Dak	500
Big Sioux River, Baltic, S. Dak	300
Flandreau, S. Dak	300
Canton, S. Dak	300
Spring Lake, Ardmore, S. Dak	300
Lake Hendriks. White, S. Dak	500
Spirit Lake, Desmet, S. Dak	225
Lake Henry, Desmet, S. Dak	225
Lake Poinset, Estelline, S. Dak	300
Artesian Lake, Hitchcock, S. Dak	300
Lake Andes, Armour, S. Dak	300
Lakes Madison and Herman, Madison, S. Dak	600
Blue Dog Lake, Wambay, S. Dak	400
Logan Lake, Mitchell, S. Dak	300
Lake Andes, Greenwood, S. Dak	300
Reservoir, Hitchcock, S. Dak	300
Lake Kampeska, Watertown, S. Dak	600
Punished Womans Lake, South Shore, S. Dak	125
Round Lake, South Shore, S. Dak	375
Reservoir, Fulton, S. Dak	150
James River, Mitchell, S. Dak	300
Spring Lake, Bonilla, S. Dak	300
Lake Artesian, Newark, S. Dak	300
Spring Lake, Springfield, S. Dak	200
Lake Campbell, Brookings, S. D	500
Swan Lake, Hurley, S. D	300
Applicants in South Dakota	500
Big Creek, Del Rio, Tenn	100
Doe River, Elizabethton, Tenn	175
Pistol Creek, Maryville, Tenn	300
Caney Fork River, Walling, Tenn	75
Sulphur Fork Creek, Cedar Hill, Tenn	100
North Chickamauga Creek, Chattanooga, Tenn	150
South Chickamauga Creek, Chattanooga, Tenn	125
Lookout Creek, Chattanooga, Tenn	125
Yellow Creek, Rockwood, Tenn	100
Hickory and Barren creeks, Viola, Tenn	175
Little River, Maryville, Tenn	300
Holston River, Sido, Tenn	200
Camp Creek, Greenville, Tenn	150
Little Pigeon River, Knoxville, Tenn	300
Hickory Creek, McMinnville, Tenn	200
Charles Creek, Yeager, Tenn	100
West Fork of Forked Deer River, Jackson, Tenn	2, 700
Tennessee River, Perryville, Tenn	200
Little Sequachee River, Sequachee, Tenn	175
Applicants in Tennessee	825
Woodlake, Marshall, Tex	30
Dairy Lake, Cisco, Tex	100
Spring Lake, Cisco, Tex	150
Waterworks Lake, Lufkin, Tex	150
Lytle Lake, Abilene, Tex	300
Lake Blanche, Austin, Tex	200
Medina River, Lacoste, Tex	200
Spring Lake, Dallas, Tex	150
Gatesvile, Tex	100
Evans Lake, Odessa, Tex	100
Cyball's Creek, Bourne, Tex	150
Sabinas Creek, Bourne, Tex	150
Willhern's Lake, Llano, Tex	400
Bold Springs, West, Tex	165
Penitentiary reservoir, Rusk, Tex	100
Leon and Salt Creeks, Marathon, Tex	200
Guadalupe River, Guahl, Tex	650
Kerryville, Tex	2, 753
Comfort, Tex	67
Willard's Lake, Corrigan, Tex	150
Pecan Creek, San Angelo, Tex	600
Little Brazos River, Hearne, Tex	100
Myers Pond, San Angelo, Tex	150
Spring Creek, San Angelo, Tex	300
Millpond, Southmayde, Tex	30
Old Brazos River, Hearne, Tex	100
Guadalupe River, Cuero, Tex	5, 100
Waring, Tex	133
Lipan Creek, San Angelo, Tex	300
Mill Pond, Gainesville, Tex	30
Mill Pond, Ben Arnold, Tex	100
Las Almos Lake, Taylor, Tex	100
Little Rocky Creek, Shiner, Tex	100
Santa Rosa Lake, Monahans, Tex	100
Salado River, San Antonio, Tex	300
Ackerman Lake, Cameron, Tex	10
Paton Lake, Round Rock, Tex	50
Flag Lake, Thornton, Tex	50
Millpond, Point, Tex	30
Water Valley Lake, San Angelo, Tex	250
North Concho River, San Angelo, Tex	400
Asylum Pond, Terrell, Tex	50
Burnette Lake, Wichita Falls, Tex	100
Cold Creek, San Angelo, Tex	300
South Concho River, San Angelo, Tex	800
M., K. & T. R. R. Lake, Leonard, Tex	200
Large Lake, Denison, Tex	150
Llano River, Llano, Tex	500
Washita River, Canadian, Tex	450
Spring Lakes, Canadian, Tex	450
Sweetwater Creek, Miami, Tex	200
Davis Lake, West, Tex	15
Lake McDonald, Austin, Tex	2, 500
Brazos River, near Waco, Tex	2, 125
North Bosque River, Waco, Tex	100
Navasota River, Groesbeck, Tex	100
Ennis Lake, Ennis, Tex	50
Lake Eloise, Waco, Tex	350
North Creek Lakes, Canadian, Tex	100
La Mota Springs, Marfa, Tex	150
Spring Creek, Miami, Tex	200
McClellan Creek, Miami, Tex	100
Coneyboy Creek, Miami, Tex	100
Lake Thorn, Long View, Tex	300
Cuero Creek, Cuero, Tex	200
Kuykendall Creek, Taylor, Tex	100
Fairland Lake, Brownwood, Tex	300
Spring Lake, Loraine, Tex	300
Lake Park Lake, Tyler, Tex	200
Horseshoe Lake, Cuero, Tex	100
Mason Lake, Kemp, Tex	100
Lake Gibbons, Paris, Tex	200
Oak Lake, Waco, Tex	100
Spring Lake, Tyler, Tex	300
Marcado Creek, Victoria, Tex	200
Lost Creek, Jacksboro, Tex	200
Groesbeck Creek, Quanah, Tex	300
Bear Creek, Vernon, Tex	200
Casino Creek, Tascosa, Tex	300
Ranch Creek, Tascosa, Tex	300
Piscaqua Creek, Tascosa, Tex	300
Spring Lake, Sherman, Tex	200
Paluxy River, Bluffdale, Tex	1, 000
Clear Fork Brazos River, Cisco, Tex	400
Clear Fork Brazos R., Jacksboro, Tex	600
Elm Fork Brazos R., Jacksboro, Tex	200
Elm Creek, Seymour, Tex	342
Millers Creek, Seymour, Tex	341
Spring Creek, Seymour, Tex	114
Spring Lake, Corsicana, Tex	100
Llano, Tex	300

Details of distribution—Continued.

Species and disposition.	Adults and yearlings.
Black bass—Continued.	
Colorado River, Smithville, Tex	5,000
Hills Lake, Longview, Tex	1,000
Leon River, Gatesville, Tex	1,000
San Saba River, San Saba, Tex	1,000
Sabine River, Mineola, Tex	600
Brazos River, San Felipe, Tex	5,000
Colorado River, Colorado, Tex	2,300
Iatan Lake, Iatan, Tex	1,000
Sulphur Draw Lake, Big Springs, Tex	1,000
San Antonio River, San Antonio, Tex	500
Frio River, near Dilley, Tex	2,000
Nueces River, Cotulla, Tex	2,500
Little River, near Temple, Tex	2,500
Bosque River, near Waco, Tex	3,000
Pecan Creek, Brownwood, Tex	700
Trinity River, near Palestine, Tex	4,600
Fort Worth, Tex	1,500
Dallas, Tex	1,500
Medina River, Medina, Tex	1,400
Applicants in Texas	17,660
Green River, Green River, Utah	100
Newton Pond, Wilmington, Vt	200
Salem Pond, Newport, Vt	100
Sabin Pond, Plainfield, Vt	100
Black Creek, Sheldon, Vt	100
Castle Creek, Arrington, Va	100
Grassey Creek, Clarksville, Va	100
James River, Lynchburg, Va	200
Millpond, Houston, Va	400
Three Otters Lake, Bedford City, Va	225
Bannister R., Franklin Junction, Va	100
Rappahannock River, Remington, Va	200
Goose Creek, Delaplain, Va	200
Falling River, Lynchburg, Va	200
Tye River, Tye River Station, Va	200
Cedar Creek, Oranda, Va	200
Robinson River, Rapidan, Va	200
North Anna River, Mineral City, Va	200
Roanoke River, Salem, Va	200
Rapidan River, Orange, Va	200
Jackson's River, Hot Springs, Va	100
Lake Kilby, Suffolk, Va	150
Cedar Creek, Cedar Creek, Va	300
Cowpasture River, Millboro, Va	300
Cherry Lake, Hardware, Va	100
Craig's Creek, Newcastle, Va	200
Mill Creek, Whittles, Va	100
Flat Creek, Lawyers, Va	100
Banister River, Houston, Va	200
Ice Pond, Haymarket, Va	100
Appomattox River, Petersburg, Va	200
Jones Millpond, Blackstone, Va	300
Baxter Pond, Petersburg, Va	200
Maple Pond, Burkeville, Va	100
Big Otter River, Bedford City, Va	200
James River, Big Island, Va	200
Millpond, Locustville, Va	50
Boulden Creek Millpond, Ridgway, Va	100
Broad Run, Bristow, Va	200
Millpond, Carson, Va	200
Middle Fork Holston R., Marion, Va	200
Ice Pond, Ellerson, Va	100
Saunders Pond, Williamsburg, Va	300
Millpond, Ninds, Va	300
Clinch River, Swords Creek, Va	200
Applicants in Virginia	3,400
American Lake, Tacoma, Wash	75
Morton Lake, Tacoma, Wash	95
Orfutts Lake, Tenino, Wash	145
Rock Lake, Winona, Wash	365
Applicants in Washington	295
Big Grave Pond, Elm Grove, W. Va	300
Wheeling Creek, Wheeling, W. Va	1,100
Deckers Creek, Morgantown, W. Va	600
West Fork Creek, Clarksburg, W. Va	500
Loop Creek, Glenjean, W. Va	225
Tygarts Valley River, Elkin, W. Va	500
Twelve-Pole River, Lavalette, W. Va	500

Species and disposition.	Adults and yearlings.
Black bass—Continued.	
Shenandoah River, Rippon, W. Va	300
Shenandoah R., Charlestown, W. Va	150
Greenbrier River, Caldwell, W. Va	375
Big Grave River, Moundsville, W. Va	500
Bartlett Lake, Parkersburg, W. Va	500
Spring Lake, Terra Alta, W. Va	500
Wheeling River, Elm Grove, W. Va	250
Applicants in West Virginia	550
Lake Winnebago, Oshkosh, Wis	85
South Park Lake, Sheridan, Wyo	40
Artificial Lake, Orin Junction, Wyo	50
Applicants in Wyoming	35
Total	208,938
Small-mouth black bass:	
Maquoketa River, Manchester, Iowa	26
State Fish Commission, Druid Hill Park, Md	10
Shenandoah R., Charlestown, W. Va	150
Total	186
Crappie:	
D. C. Riggs's pond, Seymour, Conn	100
Wyoming Lake, Wyoming, Del	100
E. G. Shortlidge, Wilmington, Del	200
Brier Creek, Waynesboro, Ga	100
Middle Oconee River, Athens, Ga	300
Millpond, Cuthbert, Ga	100
Little Cedar Millpond, Rome, Ga	100
Sealys Pond, Cuthbert, Ga	200
Swamp Creek, Jasper, Ga	400
Millpond, Graves Station, Ga	100
Flint River, Albany, Ga	200
Beaver Creek, Zenith, Ga	100
Tallapoosa River, Carrollton, Ga	100
Butler's Millpond, Cuthbert, Ga	50
Muckalee Creek, Americus, Ga	100
Applicants in Georgia	97
Gage Lake, Grayslake, Ill	1,600
Highland Park Lake, Galesburg, Ill	800
Iroquois Pond, Charlestown, Ind	150
Sylvan Lake, Rome City, Ind	300
Sugar Creek, Crawfordsville, Ind	200
Big Indian Creek, Mott, Ind	300
Lake Maxinkuckee, Culver, Ind	500
White River, Noblesville, Ind	300
Applicants in Indiana	100
Torg Lake, Louisville, Ky	100
Kinnikinnick River, Vanceburg, Ky	300
Paradise Lake, Paducah, Ky	200
Clear Creek, Wildie, Ky	300
East Side Lake, St. Charles, Ky	200
Applicants in Kentucky	200
Youghiogheny River, Swanton, Md	200
Potomac River, Woodmont, Md	500
Patuxent River, Sandy Springs, Md	200
Park Lake, Tupelo, Miss	260
Spring Lake, La Belle, Mo	100
Susquehanna River, Selins Grove, Pa	50
Spring Lake, Roaring Springs, Pa	50
Wyoming Creek, Reading, Pa	50
Cartright Lake, East Stroudsburg, Pa	100
Conococheague Creek, Greencastle, Pa	100
Cordorus Creek, Emigsville, Pa	75
Big Conewago Creek, Emigsville, Pa	75
Conedogwinit Creek, Carlisle, Pa	100
Juniata River, Altoona, Pa	50
Lake Maylulie, Cresson, Pa	100
Shawanese Lake, Outlet Station, Pa	50
Roaring River, Altoona, Pa	50
Schuylkill River, Birdsboro, Pa	50
North Witmer Run, Berwindale, Pa	100
Clarion River, Ridgway, Pa	50
City Reservoir, Washington, Pa	50
Conestoga Creek, Lancaster, Pa	50

Details of distribution—Continued.

Species and disposition.	Adults and yearlings.
Crappie—Continued.	
West Branch of Brandywine Creek, Modena, Pa	50
Luthers Pond, Troy, Pa	50
Saylor Lake, Bethlehem, Pa	200
Schuylkill River, Norristown, Pa	150
Allegheny River, Thompson, Pa	75
Susquehanna River, Halls, Pa	125
French Creek, St. Peter, Pa	50
Susquehanna River, Meehoopany, Pa	50
Indian Creek, Macungie, Pa	50
Water Co. Reservoir, Altoona, Pa	50
Forest Lake, East Stroudsburg, Pa	100
Applicants in Tennessee	260
Willow Lake, Pittsburg, Tex	25
Marcado Creek, Victoria, Tex	25
Meadow Brook, Waco, Tex	25
Salino Creek Lake, Tyler, Tex	25
Dallas Fishing Club Lake, Dallas, Tex	40
Lake Eloise, Waco, Tex	50
West Fork Trinity River, Fort Worth, Tex	18
Clear Fork Trinity River, Fort Worth, Tex	36
Guadalupe River, Kerrville, Tex	25
Medina River, Medina, Tex	50
San Felipe Creek, Del Rio, Tex	25
Cleveland Lake, Sugarland, Tex	25
Lytle Lake, Abilene, Tex	10
Tucker Lake, Tyler, Tex	25
Reservoir, Beeville, Tex	25
Lake Park Lake, Tyler, Tex	25
Bold Springs, West, Tex	50
Pine Lake, Palestine, Tex	25
Willard Lake, Willard, Tex	25
Applicants in Texas	470
Saunders Pond, Williamsburg, Va	100
Applicants in Virginia	150
Shenandoah R., Charlestown, W. Va	150
Wheeling River, Elm Grove, W. Va	1,000
Total	13,941
Rock bass:	
Spring Branch, Birmingham, Ala	65
Applicants in Alabama	300
Oak Creek, Jerome, Ariz	100
S. F. & P. R. R. Reservoir, Williams, Ariz	500
Silver Pond, Benson, Ariz	150
Applicants in Arizona	100
Arkansas	100
Spring Lake, Cayuga, Ind	100
Iroquois Pond, Charlestown, Ind	100
Horseshoe Lake, Wynnwood, Ind. T	300
Applicants in Indian Territory	200
Honey Creek, Manchester, Iowa	300
Crystal Lake, De Witt, Iowa	400
Applicants in Iowa	100
Forest Lake, Bonner Springs, Kans	100
Buckner Creek, Jetmore, Kans	400
Spring Creek Lake, Meade, Kans	100
Plum Creek, Phillipsburg, Kans	200
Crow Creek, Phillipsburg, Kans	200
Eureka Lake, Manhattan, Kans	100
Deep Creek, Manhattan, Kans	100
Labette Creek, Erie, Kans	200
Tuttle Creek, Manhattan, Kans	100
Applicants in Kansas	7,500

Species and disposition.	Adults and yearlings.
Rock bass—Continued.	
McKenna Lake, Taylorsville, Ky	100
Applicants in Kentucky	175
Lake Tasse, Cypremont, La	200
Grand Cote Lake, Cypremont, La	200
Tangipahoa River, Ponchatoula, La	500
Inland Lake, Jeanerette, La	200
Applicants in Louisiana	700
Van Etten Lake, Au Sable, Mich	500
Applicants in Michigan	250
Swan Lake, Shuqualak, Miss	200
Spring Lake, Macon, Miss	200
Millpond, Shuqualak, Miss	150
Applicants in Mississippi	815
Cut-Off Lake, Brunswick, Mo	100
Spring City Lake, Joplin, Mo	40
Applicants in Missouri	800
Spring Lake, Watrous, N. Mex	200
Applicants in Ohio	200
Oklahoma	900
West Branch of Susquehanna River, Milton, Pa	200
Codorus Creek, Emigsville, Pa	100
Big Conewago Creek, Emigsville, Pa	100
Lake Rowena, Cresson, Pa	200
Beech Lake, Honesdale, Pa	200
Applicants in Pennsylvania	400
Sioux River, Sioux Falls, S. Dak	25
Crooked Creek, Maryville, Tenn	138
Buffalo River, Perryville, Tenn	100
Applicants in Tennessee	1,000
Caloway Lake, Arlington, Tex	200
Wendemire Lake, Waco, Tex	400
Elm Lake, Cameron, Tex	300
Canyon Lake, Cisco, Tex	25
Spring Lake, Cisco, Tex	300
Lake Wallace, Cisco, Tex	200
Clear Fork Trinity River, Fort Worth, Tex	285
Spivey Lake, Kerens, Tex	25
Lake Como, Brenham, Tex	100
Blue Spring, Argyle, Tex	100
Spring Lake, Mount Pleasant, Tex	100
Lytle Lake, Abilene, Tex	15
Indian Lake, Palestine, Tex	200
Spring Lake, Palestine, Tex	200
Catfish Lake, Tyler, Tex	100
Reservoir, Beeville, Tex	100
Spring Lake, Tyler, Tex	200
Pine Lake, West, Tex	15
Cleveland Lake, Sugarland, Tex	100
Rider Lake, Weatherford, Tex	100
Old Brazos River, Hearne, Tex	200
Spring Lake, Alvarado, Tex	100
Goodnight Lake, Kerens, Tex	25
Ackerman Lake, Cameron, Tex	20
Spring Lake, Hillsboro, Tex	200
Pinnell Lake, Weatherford, Tex	225
Davis Lake, West, Tex	15
Ennis Lake, Ennis, Tex	25
Applicants in Texas	4,609
Total	29,192
Strawberry bass:	
Little Prairie Creek, Newburg, Mo	100
Spring City Lake, Joplin, Mo	160
Applicants in Missouri	50
Total	310

Details of distribution—Continued.

Species and disposition.	Fry and fingerlings.
Cod:	
Vineyard Sound, off—	
Jobs Neck, Mass	16,698,000
Tarpaulin Cove, Mass	14,292,000
Robinsons Hole, Mass	17,823,000
Gayhead, Mass	13,536,000
Woods Hole, Mass	608,000
Quicks Hole, Mass	3,408,000
Cuttyhunk, Mass	2,605,000
Nashawena Island, Mass	2,272,000
Cedar Tree Neck, Mass	478,000
Nonamesset Island, Mass	1,559,000
Massachusetts Bay—	
Gloucester, Mass.[1]	41,003,000
Magnolia, Mass	3,084,000
Provincetown Harbor, Mass	2,404,000
Massachusetts coast waters, Rockport, Mass	10,928,000
Ipswich Bay, Rockport, Mass	9,305,000
Eel Pond, Woods Hole, Mass	2,266,000
Atlantic coast waters—	
Gloucester, Mass	18,840,000
Rockport, Mass	23,285,000
Woods Hole Harbor, Mass	14,194,000
Total	198,588,000
Pollock:	
Massachusetts Bay, Gloucester, Mass	834,000
Flat-fish:	
Woods Hole Harbor, Mass	36,098,000
Eel Pond, Woods Hole, Mass	1,228,000
Buzzards Bay, Woods Hole, Mass	6,312,000
Quissett Harbor, Quissett, Mass	2,391,000
Cuttyhunk Pond, Gosnold, Mass	2,200,000
Greenwich Bay, East Greenwich, R. I	4,212,000
Total	52,441,000
Lobster:	
Fisher Island Sound, off—	
Noank, Conn	1,962,000
Stonington, Conn	1,540,000
Fisher Island, Conn	2,215,000
Gulf of Maine, off Wood Island, Me	1,000,000
Casco Bay—	
Northeast side Pumpkin Knut, Me	1,200,000
Off Long Island, Me	2,400,000
Diamond Island, Me	2,400,000
Peak Island, Me	1,200,000
Orr Island Me	600,000
Wells Strait, Me	600,000
Off Ram Island, Me	1,200,000
Cousin Island, Me	1,200,000
Little John Island, Me	1,200,000
Chebeag Island, Me	1,200,000
Pemequid Bay, off Burnt Island, Me	1,500,000
Boothby Harbor, off Mouse Island, Me	500,000
Gulf of Maine, off Damascove Island, Me	600,000
Linekin Bay (eastern part), Me	600,000
Gulf of Maine, off—	
Petitmanan Island, Me	200,000
Beal Island, Me	200,000
Great Wass Island, Me	200,000
Libby Island, Me	200,000
Portland, Me	2,525,000
Atlantic Ocean—	
Off Kittery Point, Me	1,200,000
York Harbor, Me	1,200,000
Wheeler Bay, off High Island, Me	400,000
Seal Harbor, off Spruce Head, Me	800,000
Muscle Ridge Channel, off Ash Island, Me	500,000
Lobster—Continued.	
Penobscot Bay, off—	
Long Island, Me	1,500,000
Metinick Island, Me	900,000
East Penobscot Bay, off Deer Island, Me	200,000
Muscongus Sound, off Harbor Island, Me	900,000
Blue Hill Bay—	
Swan Island Harbor, Me	200,000
North Point, Long Island, Me	200,000
Frenchman Bay, off—	
Southeast shore of Baker Island, Me	200,000
North Point, Schoodic Island, Me	200,000
Prospect Harbor, off light-house in outer Prospect Harbor, Me	200,000
Moosabec Reach (western entrance), Me	200,000
Bay of Fundy, off Eastport wharf, Me	200,000
Atlantic Ocean—	
Off York Harbor, Me	2,400,000
Low Eddy, York Harbor, Me	1,200,000
Buzzards Bay—	
Gosnold, Mass	620,000
Off Long Neck, Mass	702,000
New Bedford, Mass	484,000
Uncatina Island, Mass	867,000
Weepecket Island, Mass	1,899,000
Cuttyhunk, Mass	2,540,000
Black Rock, North Ledge, Mass	811,000
Hadley Harbor, off—	
Gosnold, Mass	123,000
Naushon Island, Mass	522,000
Woods Hole Harbor, Mass	1,164,000
Vineyard Sound—	
Lackeys Bay, Mass	1,622,000
Menemsha Bight, Mass	548,000
Off Can Buoy, Mass	2,600,000
Cedartree Neck, Mass	3,152,000
Great Harbor, Mass	2,207,000
Nobska Point, Mass	723,000
Gosnold, Mass	410,000
Massachusetts Bay—	
Gloucester, Mass	12,525,000
Off Manchester, Mass	2,420,000
Boston, Mass	1,750,000
Hospital Point, Beverley, Mass	770,000
Provincetown Harbor, off Cape Cod, Mass	1,110,000
Massachusetts coast waters, Gloucester, Mass	1,150,000
Wellfleet Harbor, Wellfleet, Mass	1,107,000
Plymouth Harbor, Plymouth, Mass	1,232,000
Woods Hole Harbor, off Grassy Island, Mass	1,728,000
Scituate Harbor, Scituate, Mass	1,038,000
Cape Cod Bay, Monomet, Mass	1,110,000
Atlantic Ocean, Gloucester, Mass	3,000,000
Atlantic coast waters off—	
Gloucester, Mass	1,590,000
Rockport, Mass	2,500,000
Rockport Harbor, off Rockport, Mass	3,100,000
Gloucester Harbor, off Gloucester, Mass	1,255,000
Boston Harbor, off Boston, Mass	1,750,000
Ipswich Bay, off Gloucester, Mass	1,875,000
Atlantic Ocean, Newcastle, N. H	3,600,000
Newport Harbor, Newport, R. I	1,150,000
Wickford Harbor, Wickford, R. I	755,000
Narragansett Bay, Wickford, R. I	755,000
Sakonnet River, off Sakonnet Point, R. I	1,157,000
Total	108,463,000

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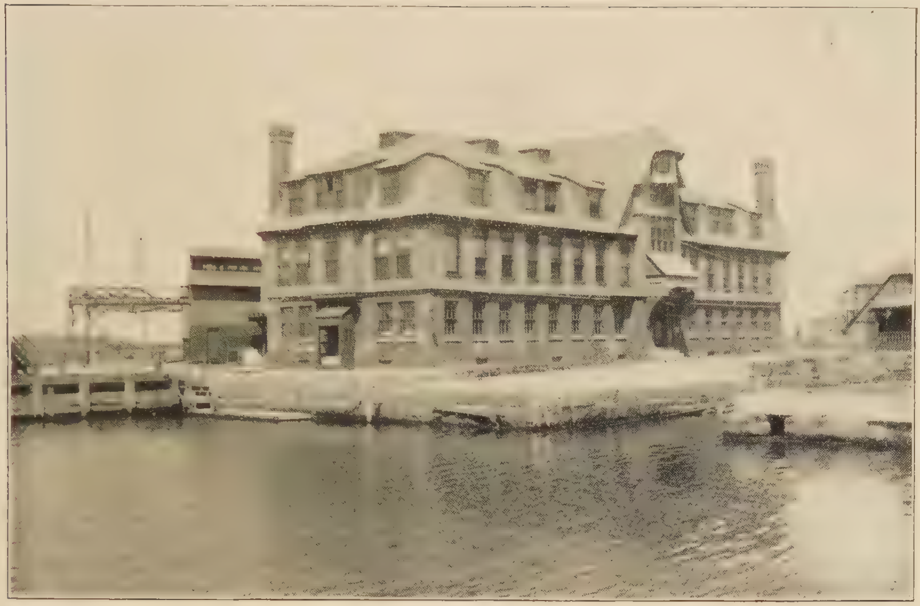
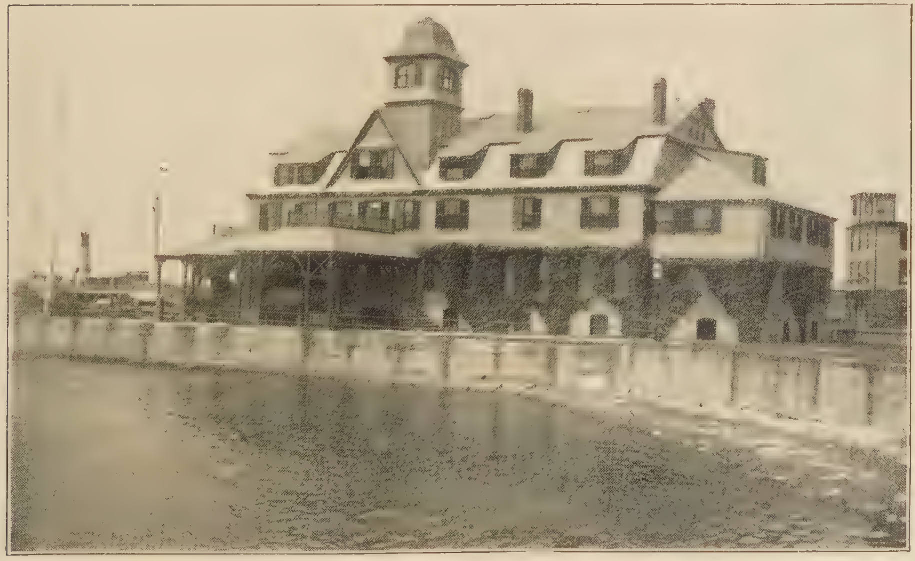
[1] 9,669,000 eggs were planted at this point.



LABORATORY, HATCHERY, AQUARIUM, AND MUSEUM, U. S. FISH COMMISSION, WOODS HOLE, MASS.



RESIDENCE, U. S. FISH COMMISSION, WOODS HOLE, MASS.

REPORT ON THE INQUIRY RESPECTING FOOD-FISHES AND THE FISHING-GROUNDS.

By HUGH M. SMITH, *Assistant in Charge.*

In the accompanying outline of the work of this division during the fiscal year 1899 there are considered (1) the investigations which have been undertaken in the lakes and streams with reference to the abundance, distribution, habits, etc., of the fishes and other animals; (2) a number of miscellaneous investigations in the waters of the Atlantic coast, including Puerto Rico; (3) special studies of important economic fishes; (4) the researches at the marine biological laboratories of the Commission, and (5) various minor inquiries and duties.

INVESTIGATIONS OF THE INTERIOR WATERS.

BIOLOGICAL SURVEY OF LAKE ERIE.

For a number of years past the Fish Commission has appreciated the importance of a systematic biological and physical investigation of the Great Lakes, in conjunction with the extensive fish-cultural operations which are there carried on by the Government and States and with canvasses of commercial fisheries by the Commission. It has been evident that the conditions affecting the supply of food-fishes could not be thoroughly understood and the institution of proper measures for maintaining the supply could not be brought about without a knowledge of the mutual relations of all the organisms directly or indirectly associated with the fishes, but more especially the minute animals and plants known to have a pronounced influence on the abundance and distribution of fishes.

As a preliminary step in the thorough exploitation of the Great Lakes in the interests of the fisheries and fish-culture, the Commission, in July, 1898, began a biological survey of Lake Erie. Headquarters were established at the Fish Commission station at Put-in Bay, Ohio, on South Bass Island, which is conveniently located in a part of the lake where commercial fishing is very extensive and where the artificial propagation of white-fish, wall-eyed pike, and lake herring is prosecuted on a large scale. Prof. Jacob Reighard, of the University of Michigan, was placed in immediate charge of the work, and the following persons were associated with him during the summer and fall: Prof. H. B. Ward, University of Nebraska; Dr. H. S. Jennings, Dartmouth College; Dr. Julia Snow, University of Michigan; Mr. A. J. Pieters, U. S. Department of Agriculture; Dr. W. C. Kendall and Mr. M. C. Marsh, U. S. Fish

Commission; Mr. R. S. Rowland, of the Univerity of Michigan, and Mr. R. C. Young. The superintendent of the station, Mr. J. J. Stranahan, and others connected with the hatchery, rendered assistance throughout the season.

Professors Reighard and Ward devoted some time to the designing, construction, and experimental use of a number of pieces of apparatus required in the plankton investigations, including a hydrophore (for bringing up samples of water from any required depth), a large plankton net, and an appliance for measuring the flow of water through plankton nets. They also gave special attention to the determination of the minute floating organisms preliminary to quantitative plankton work; 103 true plankton organisms were found, of which 6 were protozoans, 4 rotifers, 9 crustaceans, and 84 algæ. It is interesting to note that Apstein records 82 plankton forms from the German lakes, 6 being protozoans, 23 rotifers, 19 crustaceans, 2 spiders, 1 mollusk, 1 turbellarian, and 31 algæ. The scarcity of protozoans and rotifers in the Lake Erie plankton, as regards both species and individuals, is somewhat surprising, as these animals are abundant in Lake St. Clair and Lake Michigan at the same season. The crustaceans are quite numerous as to individuals, but not as to species, while the algæ are exceedingly abundant as regards both individuals and species. The Lake Erie plankton, therefore, as thus far studied, consists practically of algæ and crustaceans.

Dr. Jennings was engaged in the study of the protozoans and rotifers of the adjacent waters. The former were studied chiefly in an experimental way, with special reference to the influences which determine the movements of aquatic organisms and the laws by which they are regulated. Taking the common ciliated infusorian, *Paramœcium caudatum*, as a representative simple organism, its activities and reactions to chemic stimuli were fully analyzed. The work was successful in establishing general principles of much importance regarding the factors which govern the movements of such animals. Two papers of Dr. Jennings, embodying the results of these studies, were published, by permission of the Commission, in the American Journal of Physiology for May, 1899. These were "The motor reactions of *Paramœcium*" and "Laws of chemotaxis in *Paramœcium*." The region was found to be exceedingly rich in protozoa, upward of 70 species being identified, although these were only a small percentage of those observed. The adjacent swamps furnished many interesting species, including the gigantic infusorian, *Bursaria truncatella*, *Volvox*, and other related forms. Special attention was directed to the forms of which cultures could be kept in the laboratory, so that they could be obtained in large quantities.

Studies of the rotifers were carried on from the systematic and faunistic standpoints. The shore, bottom, and swamp rotifers were exceedingly abundant, but those of the open waters were very scarce. About 100 species of rotifers were identified, including some new and rare forms, one of considerable interest being *Trochosphæra*, originally described from China and recently found in the Illinois River. An extended illustrated report on the rotifers is in preparation.

In addition to his other duties Professor Ward was engaged in the collection and study of the parasites infesting fish.

Dr. Snow gave attention to the determination of the microscopic aquatic plants of the neighborhood, especially those occurring in the plankton. By means of cultures the identification of many species was greatly facilitated, and species were found in the plankton that would otherwise have been overlooked. Experiments were conducted showing the rate of growth of the lower forms of algæ, and many interesting observations were made on these important constituents of the plankton. During the season 130 species were noted, of which 84 were found in the plankton, as before stated.

Mr. Pieters's inquiries were directed to the aquatic plant life in the harbor of Put-in Bay, East and West harbors, Portage River, and Sandusky Bay, and consisted in part in making an inventory of the plants and in part in a determination of the laws of their distribution. Intimate relations exist between the water-plants and the fish.

During August, September, and October, Dr. Kendall and Mr. Marsh made collections of the fishes of the Put-in Bay region and other parts of the lake, studied their food habits, and collected parasites and the contents of fishes' stomachs. Forty-two species of fish were detected at Put-in Bay, and over 700 stomachs, representing 27 species, were examined. Efforts to secure young white-fish with shore seines, small-mesh gill nets, and other apparatus were unsuccessful.

With slight modifications the hatching-room at the station was found to be well suited for laboratory purposes, being commodious, light, and supplied with gas and running water, as well as close to the dock. The diversity of the surroundings makes the Put-in Bay region an excellent place for the study of important general problems pertaining to the fisheries of the Great Lakes. As a location for summer work it has unusual advantages, and arrangements have been made for the renewal of the investigations during 1899. There is, however, no deep water near Put-in Bay, and this is a drawback to studies of the plankton and of the life-history of the white-fish and some other species. Should it be determined to establish a permanent biological station on the lakes, a more favorable site might be found, but a decision on this matter must depend on an examination of other regions.

THE SEBAGO LAKE BASIN.

Sebago Lake ranks second in size among the many large lakes of Maine, and from the fish-cultural, angling, and scientific standpoints is one of the most interesting bodies of water in the United States. It was from this lake that Girard, in 1852, received the specimens of landlocked salmon on which he based his description of *Salmo sebago*, a fish which has since come into great prominence on account of its superior game and food qualities, and has been extensively propagated by both national and State authorities. Various other features of the fish fauna cf this lake and adjacent waters are also of general interest. In pursuance of the policy of the Fish Commission of investigating the biological and physical conditions and the fishery resources of the important inland waters, Sebago Lake seemed to afford an inviting field for the inauguration of an examination of the lake systems of Maine, whose inland fishing resources are perhaps more carefully guarded and generously fostered than those of any other State. The facts that no systematic examination of the fish fauna of this lake had ever been made, that it had been the field for extensive fish-cultural operations, and that the supply of its most noted fish was apparently diminishing, were additional reasons for taking up this inquiry.

Accordingly, in 1898, Dr. W. C. Kendall, of this division, began an investigation of the Sebago basin; the work commenced on July 1 and continued until the early part of August of that year, and being resumed on May 20, 1899, was in progress at the close of the fiscal year. That part of the extensive Sebago basin which was examined during this period included Sebago and Little Sebago lakes; Thomas, Panther, Rattlesnake, Pettengill, and Chism ponds; Songo and Presumpscot rivers, and various small ponds and brooks.

The primary object of the inquiry was a thorough study of the landlocked salmon, its habits and environment. Due attention, however, was given to other fishes of the region. The physical features of the waters (depth, temperature at different depths, character and contour of bottom) and the general faunal and floral aspects were considered because of their important bearing on the salmon and other fishes.

The salmon of Sebago Lake attain a larger size than those of any other American lake. Their maximum weight is 25 pounds, and the average is 8 or 10 pounds. The largest captured in 1899 weighed 17½ pounds. As soon as the lake is free from ice salmon-fishing begins, the fish being then in eager pursuit of the smelt (*Osmerus mordax*), which are running up the streams from the lake to spawn. The smelt is the principal food of the salmon at this and other times. When the run of smelt is over salmon-fishing is considered as at an end, owing to the erroneous assumption that salmon will not bite again during the season. Although fishing has of late been comparatively poor and has apparently not been improved by the planting of many thousands of fry, the salmon are still fairly numerous, as shown by the numbers observed on the spawning-beds in fall. An abundance of natural food may have caused the recent diminished catch; this theory is entertained by some persons. Another explanation is that the fish descend to the sea over dams and other obstructions which prevent any return to the lake.

Whether the landlocked salmon is a distinct species or only a variety of the sea-going fish (*Salmo salar*) is a question not yet settled to the satisfaction of all zoologists, for the reason that no one has had material enough for study to enable him to reach a definite opinion. The indications are that further research will reveal enough structural differences to establish the landlocked salmon of the Sebago system as a species distinct from the sea salmon, unless intergradations be found through the various forms of landlocked salmon of Sebec Lake, Union River, Grand Lake, and the Canadian streams.

Salmon locally known as "jumpers" are found in the Presumpscot River throughout the year, and may be taken at all times with artificial fly or other lure; they do not enter the lake. These fish differ in size and color from the regular lake salmon, and reach maturity when 10 or 11 inches long. Their maximum weight is 4 pounds, but the average is only 1 to 1½ pounds. The "jumpers" subsist largely on insects and insect larvæ. A critical examination of the large series of those fish that was preserved may show that they are specifically distinct from the landlocked salmon, although it is more probable that they will prove to be simply the landlocked form that has been modified by a restricted habitat.

Smelts are the most abundant fishes inhabiting the lake. During warm weather they live at a depth of 100 to 150 feet. At times they rise to the surface, and for some unknown reason migrate in large bodies, acres in extent, from one part of the lake to another. During such movements salmon may usually be observed in the vicinity. The Sebago smelts represent two forms, one reaching maturity when 5 or 6 inches long, the other becoming much larger (from ¾ to 1½ pounds).

Other species inhabiting this lake are brook trout (*Salvelinus fontinalis*), pickerel (*Lucius reticulatus*), horn-pout (*Ameiurus nebulosus*), sucker (*Catostomus commersonii*), eel (*Anguilla chrysypa*), sun fish (*Eupomotis gibbosus*), black bass (*Micropterus dolomieu*), yellow perch (*Perca flavescens*), white perch (*Morone americana*), fresh-water cusk (*Lota maculosa*), and various cyprinoids.

Little Sebago Lake has a fish fauna similar to that of the larger lake, but, so far as known, contains no salmon. Black bass and pickerel are the principal game-fish, the former being very abundant and attaining a large size. Thomas Pond is connected with Sebago Lake by a short stream obstructed by a milldam. Trout-fishing is good here in spring and summer, and an occasional salmon is taken, but it is always a long, slender male, known as a "racer," probably a survivor of plants made in the pond a number of years ago. Panther and Rattlesnake ponds contain trout, and have been stocked with salmon; the latter, however, are never caught, although sometimes observed in Panther Pond on gravelly shoals in fall.

GREAT SALT LAKE.

For a number of years the citizens of Utah have from time to time agitated the question of utilizing for fish-cultural purposes the waters of Great Salt Lake, and have expressed the wish that the general government, through the U. S. Fish Commission, would make the necessary investigation to determine the feasibility of the project. The Commission has also been importuned to make experimental plants of fish and other animals in the lake and its tributary streams. While it was known that the salinity of the open lake is so great as to preclude the possibility of the acclimatization of useful marine animals, it had been suggested that in certain bays or arms of the lake, in which the rivers discharge, and where the density is lowered to a point somewhat less than that of ocean water, it might be possible for oysters and clams, crabs, terrapins, and even fish to survive and multiply.

In September, 1898, Dr. H. F. Moore was ordered to Utah, and spent about a month in studying the physical conditions of this lake near the mouths of Bear, Weber, and Jordan rivers, and in ascertaining the availability for aquiculture of several brackish springs in the vicinity of the lake. A report* on this investigation will be found among the appendices in the present volume.

Great Salt Lake has a length of 80 miles and a maximum width of 35 miles, the area in 1898 being about 1,750 square miles. The drainage area of the Great Salt Lake basin is about 54,000 square miles. Nearly all the fresh water entering the lake is discharged by the three rivers named. The density of the open lake in November, 1897, was 1.168, or more than seven times the maximum density in which oysters will grow.

It was appreciated by the Commission at the outset that the only possible chance for acclimatization experiments was in those parts of the lake where the rivers debouched. It was found, however, that the zone of mixed water was not only very narrow, but also had no fixed position, moving irregularly back and forth under the influence of several agencies beyond control. To attempt, therefore, to introduce oysters, crabs, or marine fishes in the lake would be manifestly useless. The objections to the planting of such animals are based on physical rather than on biological conditions, as there is an abundant food supply, brine shrimp (*Artemia gracilis*), insect larvæ, and minute plants being very numerous. While it is not improbable that oysters could be raised in suitably constructed ponds fed by some of the brackish springs, the venture would be costly and might not prove financially successful, even if feasible as an experiment.

While the results of the investigation were thus entirely negative as regards the practicability of introducing useful animals into the lake, the work was useful in setting the question at rest and in providing definite data with which to answer those persons who have cherished the belief that the lake might be thus utilized.

Attention may be drawn to the probability of increasing the fish supply of this region by introducing cat-fish and other hardy species in the fresh-water sloughs near the mouths of the rivers. Efforts to secure a run of shad or other anadromous fishes in the rivers entering the lake will, however, undoubtedly fail. Considerable numbers of young shad have been deposited by the Commission in these streams, but there are no evidences of their survival.

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*An inquiry into the feasibility of introducing useful marine animals into the waters of Great Salt Lake. By H. F. Moore. Report U. S. Fish Commission 1899, pp. 231-250.

DISTRICT OF COLUMBIA.

Studies of the fish life of the District of Columbia and vicinity, which had been in progress for several years, resulted in the preparation of a preliminary report* on the subject by Dr. H. M. Smith and Mr. B. A. Bean. Although the food and game fishes of the region have received considerable attention, there has been little notice taken of the smaller species which are important as food for the others, and no list of the fishes of the locality has been published.

The observations and collections so far made show a more extensive fish fauna than has generally been attributed to the region, while further inquiry will doubtless disclose the occurrence of other species. The number of species at present known is 81, of which about 30 are of direct economic value. The work of the Commission in acclimatizing useful fishes has been very successful in the Potomac, some of the best species having been introduced. Among those which have become abundant are the large-mouth black bass, small-mouth black bass, calico bass, and crappie. One of the most interesting features of the District fauna is the regular or accidental appearance of typical salt-water fishes, about a dozen of which have thus far been recorded.

SAN PEDRO RIVER, ARIZONA.

This stream is one of the southern tributaries of the Gila River, a branch of the Colorado. It rises in Mexico and pursues a northerly course of about 130 miles in Arizona before joining the Gila. The fish fauna of the river has been practically unknown. In the spring of 1899 Dr. P. H. Kirsch, formerly fish commissioner of Indiana, but now residing in Arizona, volunteered to make an examination of the fish life of this river for the Commission and prepare a report thereon. The inquiries began in the vicinity of Benson, and will be extended so as to embrace the entire basin of this river.

BASIN OF THE COLUMBIA RIVER.

Lake Chelan, Washington.—In August, 1898, Prof. B. W. Evermann visited Lake Chelan, Washington, for the purpose of determining the general features of the fish fauna, and whether any species of salmon resort to it or its tributaries for spawning purposes. This lake is one of the largest bodies of water in the interior of the Northwestern States, and is by far the largest lake in Washington. It is located wholly in Okanogan County, and extends in a generally northwesterly direction for 60 or 65 miles, its width varying from three-fourths of a mile to 2 miles. It occupies the bed of an old glacier, and on the north is surrounded by high mountains of the Cascade Range, but at the lower end there are only hills. The lake discharges into the Columbia River through an outlet—the Chelan River—8 or 9 miles long, the descent from the lake to the Columbia of 445 feet being broken by a series of rapids and cascades. While the falls are quite high during low water, it is thought they do not constitute a barrier to passage of fish when there is high water in the Columbia. The lake water is very cold, but never freezes except in the bays. The elevation of the lake surface is 1,108 feet, and the maximum known depth is 1,499 feet.

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* List of fishes known to inhabit waters of the District of Columbia and vicinity.

Among the fishes inhabiting the lake are the following, all of which are more or less abundant: Bull trout (*Salvelinus parkei*), lake trout (*Salmo clarkii*), sucker (*Catostomus macrocheilus*), squaw-fish (*Ptychocheilus oregonensis*), chub (*Mylocheilus caurinus*), white-fish (*Coregonus williamsoni*), and fresh-water cusk (*Lota maculosa*). It is the general opinion among people living in the vicinity that no kinds of salmon ever reach the lake Further study of the fishes and the other animal resources of this lake would prove interesting, and a small party might well devote a season to the investigation.

Kootenay Lake and River.—Kootenay Lake and its tributaries are in the basin of the Upper Columbia River, and are of importance in connection with the extensive studies of the salmon and other fishes of that stream that have been carried on by the Commission in recent years. The Kootenay is a large stream rising on the slopes of Mount Stephen and Mount Lefroy in British Columbia; it flows south into Montana, then west and northwest through Idaho, and then back into British Columbia, where it widens into Kootenay Lake, which extends north and south about 100 miles. The lake is peculiar in having its outlet on the west side about equally distant from the two ends, and the flow of water is thus from both ends toward the middle. The outlet, Kootenay River, is about 50 miles long, and flows into the Columbia. It is a very rapid stream, full of cascades and turbulent rapids. Although perhaps no one of the falls forms a barrier to the ascent of salmon, it seems almost impossible that fish would be able to surmount the entire series. For a distance of about 90 miles the upper part of Kootenay River is approximately parallel with and only a few miles from the Columbia, but flows in an opposite direction. It then trends toward the west and runs within a few rods of Upper Columbia Lake, the source of Columbia River. It is reported that several years ago a channel was cut between these waters and that boats were thus enabled to pass from one to the other; though no longer used for such purposes, the water connection is said to still exist.

A preliminary examination of this region was made by Prof. B. W. Evermann in August, 1898. Kootenay Lake was visited at Nelson, British Columbia, 200 miles north of Spokane, Washington, and inquiries as to the lake and river were made at Bonners Ferry, Kootenay Falls, and Yakt, on the Great Northern Railroad. The fishes ascertained to inhabit these waters include sucker (*Catostomus macrocheilus*), squaw-fish (*Ptychocheilus oregonensis*), white chub (*Mylocheilus caurinus*), several trouts (*Salmo*), locally called "lake trout," "brook trout," "rainbow trout," and "salmon trout;" white-fish (*Coregonus williamsoni*), and red fish (*Oncorhynchus nerka*). The small form of the red-fish was found in several creeks in the vicinity of Nelson, and seems to be generally distributed throughout the region. It is utilized to a limited extent for food, and is regarded as a food-fish when first seen in the streams. It has the same habits exhibited by the little red-fish of the Idaho lakes; it is observed only in the fall, and then in the small streams where it goes to spawn. The fish is probably resident in the region, though the evidence is not conclusive.

Lake Cœur d'Alene, Idaho.—This lake has considerable interest to the Commission because of an attempt to establish therein the common white-fish (*Coregonus clupeiformis*) of the Great Lakes. In February, 1889, the Commission planted 1,930,000 white-fish fry in 8 lots, and had reason to believe that the cold, clear, deep water of the lake would prove suitable to that species. On several occasions since the deposits were made, representatives of the Commission have visited the lake and searched for white-fish, but have learned nothing indicating that the fish have survived. Several reports of the capture of the introduced species have from time to time been received, but the evidence has indicated some other fish. In August, 1898, Prof. Evermann made a short visit to Lake Cœur d'Alene in order to secure additional information on this subject and to determine the advisability of a thorough investigation regarding the results of the plants and the adaptability of the lake to this species of food-fish.

The native fishes of this lake, so far as known, are bull trout (*Salvelinus parkei*), black-spotted trout (*Salmo clarkii*), western white-fish (*Coregonus williamsoni*), two suckers (*Catostomus catostomus* and *C. macrocheilus*), squaw-fish (*Ptychocheilus oregonensis*), minnow (*Leuciscus balteatus*), short minnow (*Agosia nubila*), dace (*Rhinichthys dulcis*), and blob (*Cottus rhotheus*). The falls in the Spokane River, about 6 miles below the lake, are effective barriers to the ascent of salmon, none of which have ever been known to reach the lake.

While several additional reports of the taking of the common white-fish were heard, Professor Evermann's inquiries led him to believe that the planted fish have not survived. The evidence, however, is inconclusive; and the outcome of the plants may remain a matter of speculation until a thorough examination of the lake is made. The methods of fishing now pursued in the lake are not adapted to the capture of the white-fish. Gill nets of relatively fine mesh, such as are used for white fish in the Great Lakes, will be required in order to demonstrate the existence of this fish in Lake Coeur d'Alene. The fishery resources of this fine body of water are of sufficient prospective importance to warrant a comprehensive investigation by the Commission while the normal conditions are still undisturbed by commercial fishing. The survey should extend over several months and continue late enough in fall to cover the spawning season of the common white-fish. Supplementary to the examination of this lake, attention should be given to tributary streams and several smaller lakes in the vicinity, especially Ferman Lake, in which the yellow perch (*Perca flavescens*) is said to be very successfully introduced, and lakes at the headwaters of the St. Joseph and Cœur d'Alene rivers.

SACRAMENTO BASIN.

In conjunction with special studies of the salmon in the Sacramento Basin, elsewhere referred to, Mr. Rutter and Mr. Chamberlain made extensive collections of the fishes and secured interesting new data concerning the distribution, abundance, etc., of the fishes in the various parts of the basin; several undescribed species were obtained. About 25 days in August and September were mainly devoted to visiting the streams tributary to Pitt River and the headwaters of Feather River and Mill Creek. Collections were also made in Goose Lake, Grasshopper Lake, Eagle Lake, and Susan River, on the road between the headwaters of Pitt and Feather rivers.

MUSSELS OF MISSISSIPPI RIVER.

The business of utilizing the shells of the native fresh-water mussels (*Naiades*) in the manufacture of buttons has been established in the United States within a comparatively few years, the headquarters of the industry being in Iowa and Illinois, in the basin of the Mississippi River. The rapid increase in the business has resulted in extraordinarily active fishing operations, and has led to the fear that the available supply of shells might become exhausted. At the request of a number of persons who were interested in the industry along a part of the Mississippi River, the Commission undertook an investigation having for its object the determination of the present conditions and methods, the mussels utilized, and the measures, if any, necessary to the maintenance of the mussel supply. The writer was assigned to this inquiry, and in July, 1898, visited the centers of the business. Special attention was given to the species of mussels utilized in button-making, their peculiarities, abundance, distribution, destruction by natural agencies, and the effects of fishing on the supply. A report* which embodies the results of this investigation is printed in the Bulletin of the Commission for 1898. The same volume also contains another timely paper on this subject, namely, "The pearly fresh-water mussels of the United States, their habits, enemies, and diseases, with suggestions for their protection," by Mr. Charles T. Simpson, of the U. S. National Museum.

Of the hundreds of species of mussels inhabiting the Mississippi basin, comparatively few are adapted for buttons, and at the present time only about a dozen species are used, but other valuable species exist in various streams to which the button-makers may eventually resort. The requirements of a shell, from the standpoint of the button-manufacturer, are sufficient thickness, uniform color of the various strata, and toughness. The following species fulfill these conditions and are now utilized at the button factories on the Mississippi, the common names being those employed by the fishermen and factory-men: "Niggerhead" (*Quadrula ebena*), "bluepoint" (*Quadrula undulata*), "yellow sandshell" or "yellow-back" (*Lampsilis anodontoides*), "slough sandshell" (*Lampsilis fallaciosus*), "mucket" (*Lampsilis ligamentinus*),

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*The mussel fishery and pearl-button industry of the Mississippi River. By Hugh M. Smith.

"pocketbooks" (*Lampsilis capax* and *L. ventricosus*), "deerhorn" or "buckhorn" (*Tritigonia verrucosa*), "butterfly" (*Plagiola securis*), and "hatchet-back" or "hackle-back" (*Symphynota complanata*). The leading species are the "niggerhead," "yellow sandshell," and "mucket," the first-named being more important than all others combined. It is shapeed like the common quahog (*Venus mercenaria*), and has a very thick and heavy shell, with a black or dark-brown epidermis and a glistening white nacre. The maximum size is 4½ or 5 inches and the average about 3 inches. It is often found over large areas, preferring muddy sand and muddy gravel, but also frequenting sandy bottom.

The mussel fishery is conducted along about 200 miles of the Mississippi, in Iowa and Illinois. The shoalness of the river makes every part accessible to rakes and tongs of the fishermen and renders the exhaustion of the grounds more certain, speedy, and complete. Although the fishery is under ten years old and in most places began within two or three years, it has already had such a marked effect on the mussel supply that the early exhaustion of the beds seems inevitable under present conditions. While physical and natural agencies—such as freshets, droughts, muskrats, etc.—are known to destroy at times large quantities of mussels, overfishing, the unnecessary destruction of small mussels, and the absence of any seasonal restrictions on the fishery, combined with the slow growth of the mussels and the long time required for the recuperation of the beds, are undoubtedly responsible for the recent great reduction in the supply.

The industry has attained such proportions, it represents so much invested capital, and employs so many people as factory-hands and fishermen that its suspension would prove a calamity to many communities. During the first six months of 1898 there were 49 button factories in operation along this part of the Mississippi; these employed over 1,400 people, who received $134,000 in wages. Upward of 1,000 additional persons were engaged in fishing. The mussel output during this period was about 4,000 tons, for which the fishermen received about $39,000. The output of factories was over 1,160,000 gross of buttons and "rough blanks," with a market value of $253,000.

In view of the general desire of those pecuniarily interested in the industry that the Commission recommend measures which seem necessary for the preservation of the mussel beds and the consequent maintenance of the industry, the following suggestions are given in the report cited, attention being directed to the fact that the States have sole jurisdiction over the matter: (1) The gathering of small mussels should be prohibited and a minimum legal size for each important species should be prescribed by law; (2) immediately previous to and during the spawning season the principal species should be unmolested, and a close season should be fixed by law; (3) provision should be made for the prevention of damage to the beds by sewage and factory refuse; (4) button manufacturers should exercise greater care in utilizing the shells, in order that the waste of raw material, which is now considerable, may be reduced.

INVESTIGATIONS IN COAST WATERS.

REDISCOVERY OF THE TILE-FISH.

The discovery of the tile-fish (*Lopholatilus chamæleonticeps*) in 1879, its apparent extinction in 1882, and the subsequent searches for it have been repeatedly referred to in the reports of the Commission and in other publications. The rediscovery of the fish in great abundance on its former grounds in the summer of 1898 constituted one of the most noteworthy investigations of the Commission and one of the leading features of the fishing industry during the year.

Search for the tile-fish from 1883 to 1891 gave only negative results, although in 1892 and 1893 a few scattering specimens were taken by the *Grampus* as an outcome of about five months' work. Subsequent years yielded no new information till 1897, when a Gloucester schooner accidentally set trawls on the former grounds and caught 30 specimens, as noted in the report of this division for 1897.

In 1898, in connection with the biological investigations of the Commission at the Woods Hole laboratory, the *Grampus* made three trips to the edge of the continental plateau in the vicinity of the 100-fathom line, south of southern New England and Long Island, for the purpose of determining the abundance of the tile-fish and the region over which its range extends. On each occasion the fish was found, and on two trips comparatively large numbers were taken. The first cruise, which began August 12, extended to a point about 70 miles off No Man's Land. When the trawls were set, 8 fine tile-fish were caught. As the vessel was insufficiently equipped with lines and bait, she returned to Woods Hole to refit, and sailed again for the tile-fish grounds on August 30. Sixty miles off Block Island the trawls were set three times on August 31, and 7, 47, and 19 tile-fish, respectively, were taken. On the 1st of September 78, weighing over 1,000 pounds, were caught and taken to Montauk Point, where they were distributed among the soldiers at Camp Wikoff. On the third trip, which terminated on October 2, the number taken was 203, weighing more than 3,000 pounds. The fishing was carried on between the sixty-ninth and seventieth meridians of west longitude—a section which the fish had not before been ascertained to inhabit. On each of these trips large fish were obtained in considerable numbers, and also a great many very small and immature specimens, weighing only 1 or 2 pounds, indicating that the species is actively breeding. The average weight was about 12 pounds.

While some additional investigations will be necessary in order to definitely determine the area of sea bottom over which the tile-fish ranges, it is now known that it has reestablished itself on a ground at least 175 miles long and 10 to 15 miles wide, at a depth varying from 60 to 120 fathoms. The proximity of this region to the great fishing centers and markets of the North Atlantic coast, and the abundance and excellent food qualities of the fish warrant a belief that a profitable fishery may be inaugurated. The trawl lines used by the *Grampus* were comparatively short, with few hooks, and were fished by only one dory;

it would therefore appear that vessels equipped as is usual for market fishing for "ground-fish" could obtain full cargoes in a few days.

The foregoing investigations were in charge of Dr. H. C. Bumpus, who gives an account of them in an article in the Fish Commission Bulletin for 1898, entitled "The reappearance of the tile-fish."

NARRAGANSETT BAY, RHODE ISLAND.

For a period of three weeks in October and November, 1898, the *Fish Hawk* was engaged in a special investigation of the waters of Narragansett Bay, for the purpose of determining the distribution of the star-fish in relation to the depth, temperature, and salinity of the water. Supplemental to this a study of the general biological conditions prevailing at different localities in the bay and in Block Island Sound was undertaken; 121 stations were selected for a careful examination of their biological and physical features, and extensive collections were made with the beam trawl. The inquiries show that the species of star-fish destructive to the oyster-beds occurs only within the bay; that there are certain localities in which the star-fish congregate and multiply with remarkable rapidity; that from these breeding stations the young are distributed to the oyster-grounds; that these nurseries might be destroyed at moderate expense; and that probably there is no invasion by star-fish from beyond the limits of the bay. The collections of invertebrates furnish data for a permanent record of the animal life at the present time, and will be of value in determining the effects of sewage and manufacturers' waste on the animals of the bay. The work was carried on at the request of the Rhode Island Commissioners of Inland Fisheries. and has been referred to in their report for 1898.

OYSTER-FATTENING EXPERIMENTS.

The experiments in the fattening of oysters at Lynnhaven River, Va., noticed in previous reports, were continued throughout the year under the direction of Dr. H. F. Moore, during whose absence in Puerto Rico Col. W. W. Blackford, of Lynnhaven, took charge of the observations.

By the end of the last fiscal year it had been fully determined that no advantage was to be gained by simply inclosing a pond, after the French method, and depending on the natural fertility of the water to produce the food essential for the rapid fattening of the oysters placed therein. A year's experience had shown that oysters under such conditions remained poor and lean, and were far inferior to those on the beds in the open waters of the river.

With these unfavorable conditions confronting the experiment, it was determined to attempt to increase the fertility of the inclosed water by adding fertilizer, in order to supply the pabulum required for the growth of the diatoms on which oysters feed. Accordingly, at intervals between June 28, 1898, and February 24, 1899, about 1,000 pounds of ordinary commercial fertilizer were put in the pond, which covers an area of 2 acres. The first lots were spread broadcast, while the last were deposited in marshy places at the head of the claire, so as to gradually leach into the pond, and thus approximate more closely the natural conditions. A barrel of lime was spread around the edge of the claire, so as to be gradually washed into the water and furnish the material required by oysters in the fabrication of the shell.

Until October the oysters in the claire remained exceedingly poor, but during that month they began to improve, and in November were in better condition than those in the near-by beds in the open water. The improvement continued during December, and by January 60 per cent were as fat as oysters ever become, and the remainder were fair. These conditions remained unchanged until about the middle of April, when the proportion of fat oysters became much reduced. From November until the early part of March the claire oysters excelled those on the nearest outside beds, but in March all of the latter became fat, and soon after the former began to deteriorate. About this time the water in the claire, which had been of low density since June, 1898, became almost fresh, owing to an unusually heavy rainfall and the absence of tides high enough to flow over the crest of the claire. The salinity of the pond could have been maintained, but it was desired to study the effect of the excessive precipitation.

The reason why 40 per cent of the oysters under observation failed to attain the quality of their neighbors is not positively known, but it seems probable that it was in part owing to an irregular distribution of the food organisms. Under natural conditions the tides are the most important agent in this distribution; but the pond, being usually cut off from tidal influence, has no currents except the weak ones occasioned by winds and slight differences in temperature. It seems not unreasonable to expect that better results might be obtained by inducing stronger currents, and hence a more even dispersal of the oyster food. A plan for attaining this end is under consideration, and may be put into execution during the next year if a more uniform fattening of the oysters does not take place. These experiments promise to lead to improvements in methods that will place oyster-culture more nearly abreast of the best methods of agriculture.

The oyster business of the Lynnhaven region was better during the season of 1898–99 than for several years. The green coloration of the oysters which had prevailed disappeared by July, 1898, and, as frequently happens after such a visitation, the oysters in many parts of the bay became quite fat in the following season. The prompt disappearance of the greenness was probably due to excessive rainfall during the summer and autumn of 1898, for it seems that this peculiar affection is in some way correlated with a deficient rainfall.

FISHES OF THE COAST OF LONG ISLAND, NEW YORK.

In September and October, 1898, the Commission had the services of the well-known ichthyologist, Dr. Tarleton H. Bean, in studying and collecting the fishes of the southern shore of Long Island, New York. For about two months before his work for the Commission began, Dr. Bean was engaged in this locality in obtaining specimens for the New York State Museum. This coast has a very rich fish fauna, and about half the salt-water and fresh-water species recorded from New York have been taken along this shore. The number of species found by Dr. Bean in the year 1898 was 84; to these may be added 79 others observed by him during previous visits, giving 163 as the present known number of species detected on this shore. A noteworthy feature of the fauna in 1898 was the absence of many fish that had been found during summer and fall in other years. Several species were recorded from Long Island for the first time, among them the rough silverside (*Kirtlandia laciniata*) and the red mullet (*Mullus auratus*). A finely-preserved series of specimens was forwarded to Washington at the close of the work, and a notice of the results of the investigation was published in *Science* for January 13, 1899.

EXPLORATION OF PUERTO RICAN WATERS.

Immediately after the acquisition of Puerto Rico by the United States plans were made by this division for an examination of the coastal and interior waters of the island for the purpose of determining the aquatic resources, about which practically nothing was known. The steamer *Fish Hawk* was assigned to the work, and sailed for Puerto Rico in December, 1898, having on board a party from the Fish Commission, Department of Agriculture, and Smithsonian Institution. Prof. B. W. Evermann was in charge of the general scientific investigations, and was assisted by Dr. H. F. Moore, Mr. M. C. Marsh, and Mr. A. H. Baldwin. Mr. August Busck represented the Department of Agriculture, and accompanied the expedition, at the request of the Department, for the purpose of studying the insects, particular attention being given to the scale insects which are liable to be introduced and become pests in the United States. Mr. A. B. Baker, of the National Zoological Park, joined the party to obtain live animals for the park and general natural-history collections for the Smithsonian Institution. The inquiries as to the economic fisheries of the island were intrusted to Mr. W. A. Wilcox, of the Commission. The *Fish Hawk* returned to the United States about the end of February, 1899.

The time allotted for the cruise was not sufficient for a thorough investigation, but the expedition was, as a whole, very successful. Although the vessel was fully equipped for all branches of marine research, the opportunity for deep-water dredging and trawling was limited, owing to the configuration of the bottom, and most of the efforts were devoted to the shores, outlying coral reefs, and short fresh-water streams. The vessel proceeded first to San Juan and thence circumnavigated the island, stopping at all places where there was safe anchorage, including Aguadilla, Mayaguez, Ponce, Arroyo, Hucares, Fajardo, and the islands of Culebra and Vieques. Frequent trips were made by members of the party to the interior, to examine the upper courses of streams, the most important being to Bayamon, Arecibo, Caguas, and El Yunque Mountain. Large collections of fishes, mollusks, crustaceans, corals, and other marine animals were obtained, and many new forms were taken. The fishes were very abundant, and over 200 species were noted, including numerous food-fishes. Important additions to our knowledge of the fauna of the Antilles were made, and valuable data concerning the fishery possibilities of the island were gathered.

As soon as the vessel returned, the collections were sorted and distributed for study to prominent specialists, a number of important groups being assigned to assistants of the U. S. National Museum. Collections of birds, plants, and land forms generally, incidentally obtained by members of the Commission, were transmitted to the National Museum. It is the intention to bring together in one volume the scientific results of the expedition, and it is expected that the work will be a valuable contribution to the knowledge of the aquatic fauna and flora of Puerto Rico and the West Indies.

STUDIES OF SPECIAL FISHES.

VARIATIONS OF MACKEREL.

Recent investigations by Mr. Walter Garstang, of the marine biological laboratory at Plymouth, England, have shown that not only do the mackerel (*Scomber scombrus*) inhabiting our coastal waters differ strikingly in structural details and color from those found on the shores of Great Britain and Ireland, but also that the mackerel of the British coast have peculiarities among themselves by which the fish from one section may be distinguished from those of another.* Similar investigations as to the mackerel of the western Atlantic would be of great scientific value and would have an important bearing on the problems connected with artificial propagation, commercial fishing, and the international relations of the fishery.

Mr. M. C. Marsh, scientific assistant in this division, was assigned to this investigation, and spent a part of May and June, 1899, in the examination of fresh mackerel in the New York markets. Owing to the almost complete failure of the southern spring mackerel fishery, it was impossible to secure for this inquiry more than a few fish from the southern grounds, but satisfactory series of mackerel from the New York and southern New England shores were obtained for examination. Hon. E. G. Blackford, of New York, extended the facilities of his Fulton Market office to the Commission's representative, and in other ways showed his interest in the work. The inquiry will be actively pushed during the next fiscal year, although several seasons may be required to collect sufficient data from all parts of the United States and Canadian coasts.

VARIATIONS OF SHAD.

From an economic and fish-cultural point of view, as well as from a purely biological standpoint, it is of interest to determine whether the shad which frequent the waters of the entire east coast of the United States belong to one race or whether different hydrographic areas have runs of shad which may be distinguished by structural and color features. Fishermen and fish-dealers often profess to distinguish by superficial characters the shad from various streams, and biologists have called attention to slight anatomical peculiarities, but the examinations have not been sufficiently extensive to establish the existence of tangible differences in shad inhabiting particular waters.

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* Journal of the Marine Biological Association, 1898.

For the purpose of settling this question, so far as possible, arrangements were made to obtain series of specimens of shad from the principal streams from Florida to Maine, and a personal examination of large numbers of shad in Albemarle Sound and the Potomac River was made by the chief of the division in the spring of 1899. Considerable material for study and much information have already been collected, but more will be required before the matter can be satisfactorily settled. Detailed data for at least 100 shad from each stream are required.

HERRING OF PASSAMAQUODDY BAY.

At the extreme northeastern part of the coast of Maine the fisheries for herring (*Clupea harengus*) are more extensive than in any other locality in the State. The chief fishing-centers are Eastport and Lubec, and the principal fishing-ground is Passamaquoddy Bay and its tributaries, lying partly in Maine and partly in New Brunswick. This fish is caught almost exclusively in brush weirs and is used principally for canning and smoking. It is not only the object of the most important fishery in the Passamaquoddy region, but is of great value as bait in the line fisheries for several members of the cod family, and also furnishes food for the fish. In the interests of the fishing industry, it is of great practical consequence to have a better understanding of the general natural history of the herring, especially the relations and movements of the several distinct schools which annually visit those waters.

In the Report of the Commission for 1896 is a paper * by Dr. H. F. Moore, in which was brought together practically all that was known concerning this subject. Reference to this article will show that in many respects our knowledge of the habits of the herring is meager and unsatisfactory, particularly as regards the migrations of the fish and the relations existing between the spring-spawning and fall-spawning schools, both of which subjects have been largely matters of speculation. It is, of course, known that schools of herring appear on different parts of the shore with more or less regularity each year, sometimes to spawn and sometimes for other purposes, but it is undetermined whence they come or whither they go and whether they are the same or different bodies of fish. To successfully and intelligently deal with several problems presented by the fishery, such as the cause of the disappearance of winter herring, it is essential that these subjects be understood.

In August and September, 1898, Dr. Moore devoted about a month to a general study of the abundance and distribution of the herring in the vicinity of Eastport and Grand Manan as compared with former seasons. Particular attention was given to the critical examination of the herring from different localities with reference to their structural peculiarities and variations. Although it is impossible to keep the erratically moving fish under direct or continuous observation, by indirect methods conclusive information may be gained as to the composition of the schools. If, for example, the school which spawns in spring has for a long time been quite distinct in its membership from the school which spawns in summer and autumn, the individuals of one school would show more or less constant minor structural differences from those of the others. The distinctness of the schools could thus be demonstrated by the detailed examination of fish taken at different seasons and places. Over 5,000 accurate measurements were made by Dr. Moore, but many more will be necessary to furnish material for final discussion.

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*Observations upon the herring and herring fisheries of the northeast coast, with special reference to the vicinity of Passamaquoddy Bay. Report U. S. Fish Commission 1896, XXII, pp. 387–442, plates 60–62.

NATURAL HISTORY OF PACIFIC SALMON.

The inquiries of Mr. Cloudsley Rutter and Mr. F. M. Chamberlain regarding the habits, movements, growth, food, etc., of the salmon of the Sacramento River, referred to in previous reports, were continued during the present year, beginning July 6, 1898, and extending without material interruption to May 13, 1899. In May and June of the previous fiscal year, when all parts of the Sacramento had been visited and seining stations established at intervals of about 17 miles between Redding and Sacramento, the last of the regular downstream migration of the fry was found.

On the resumption of the investigation the same ground was again gone over, and, in addition, the lakes at the source of the Sacramento were visited and the Pitt River basin was explored, the distribution of the salmon therein being determined. One station favorable for observation, located at Sims, on the Upper Sacramento, was visited monthly from April to December in order to ascertain the relative numbers and growth of the young salmon remaining in that part of the stream.

During October and November a trap arranged for catching even the smallest salmon fry—set in Battle Creek and tended by Mr. Rutter—yielded some noteworthy results. Another trap in an adjacent part of the Sacramento River was visited regularly by Mr. Chamberlain from January to April. A third, placed in Georgianna Slough at Walnut Grove, in the lower course of the river, was tended by Mr. N. B. Scofield and Mr. Rutter from January to May.

The inquiries are now practically complete, and a comprehensive report on the natural history of the salmon is being prepared by Mr. Rutter. The following are some of the facts regarding the life of the salmon in the Sacramento River established by the investigation:

(1) Adult salmon may be found in the Sacramento at almost any time of the year; the smallest numbers are observed in the lower river during winter.

(2) There are two main runs of salmon, known as the spring and summer runs in the lower part of the river, and as the summer and fall runs in the upper waters. The fish in the early run ascend to the headwaters because the water is high and suitable spawning-grounds

can not be found in the main stream. By the time the later run reaches the middle section of the river, that is to say, from Chico to Redding, the water is so low that many fish are obliged to spawn in the main river, where numerous spawning-beds are found. The salmon of the later run, therefore, rarely go beyond Redding.

(3) The spawning period of the early run is between July and September, of the later run during November and December, though occasional spawning fish may be found any time from April to January.

(4) Shallow water with gravelly bottom and swift current is usually selected for the spawning-beds. The female selects a place, extrudes a few eggs, and moves away; the male immediately takes the same position, or sometimes a few feet farther downstream, and emits a small quantity of milt. These acts are repeated at short intervals for 10 days or 2 weeks, continuing day and night. The few eggs that are not at once devoured by small fishes float several feet or yards downstream and lodge among the gravel, where they hatch in 40 to 70 days, according to the temperature.

(5) The so-called "nests" of spawning salmon are not nests in any sense of the word, as they are not intended for eggs and do not receive eggs. These excavations, several feet in diameter and often 6 or 8 inches deep, are made by the female turning on her side and digging her tail in the gravelly bottom; the movement is probably for the purpose of loosening the eggs from the ovarian sac. Incidentally, some of the eggs may thus be covered by fine sediment, which drifts downstream.

(6) The alevins hide among the rocks about six weeks. As soon as they are able to swim, they begin feeding and moving downstream. At first they travel more at night, but as they get older and reach the lower part of the river, they migrate mostly by day. They require about three months to pass from Redding to San Francisco Bay.

(7) There are two runs of salmon fry down the river, one passing the vicinity of Redding during October, November, and December, the other during the latter part of January, February, and March. Practically all the young salmon have left the region by the 1st of April, although a few remain in the headwaters all summer.

(8) Most of the salmon return to fresh water at the age of 2½ years, and spawn 36 months after the spawning of the parents. Some, however, are a year older when they leave the sea.

The planting of salmon fry near the ocean, in order that they may not have to run the gauntlet of enemies in their long journey to the salt water, has from time to time been suggested. To test the feasibility of this project, Mr. Rutter took 50,000 salmon eggs from Battle Creek to Pacific Grove, on Monterey Bay; the eggs reached the coast on December 12 and were hatched December 19. The experiments concluded February 15. It was shown that salmon fry can not go directly from fresh to salt water, but need to pass through an estuary of brackish water. An alternation of density, such as is secured by the tides, appears to be beneficial. It was further shown that under the age of two months salmon can not live in pure salt water.

BIOLOGICAL LABORATORIES.

WOODS HOLE, MASSACHUSETTS.

Announcement was made in the last report of the appointment of Dr. H. C. Bumpus as director of the laboratory and of the intention of the Commission to keep the laboratory open throughout the year for the accommodation of those persons who might desire to carry on investigations in fall, winter, and spring. The year ending June 30, 1899, was one of the most successful in the history of the laboratory, and the investigations were much encouraged by the Commissioner, who was present at the station during a large part of the summer. The laboratory assistants were Prof. R. W. Tower, Mr. G. H. Sherwood, Mr. E. E. Tyzzer, and Mr. Vinal N. Edwards. The regular employees of the station, under the direction of Mr. E. F. Locke, rendered frequent and valuable assistance. The following abstract of the investigations and of the incidental work carried on at the laboratory is taken chiefly from the report of the director.

The already large equipment of the laboratory was supplemented by new apparatus, instruments, glassware, etc., and a stock of chemicals for carrying on physiological, histological, and microscopical research; additional rooms were provided for investigators; an excellent camera, especially adapted for taking life-size photographs of water animals, was provided, and the photographic room was replenished. The apparatus for the collecting of fishes and other animals was increased by a 250-foot purse seine, a 5-foot beam-trawl, 10 deep-sea traps, and 3 complete sets of trawl lines. One of the most important adjuncts of the laboratory was a fish-trap or pound net. In previous years the fish-traps in Buzzards Bay had furnished valuable data relative to the migrations, breeding, and abundance of fish, besides providing material for laboratory work; but in 1898 the laws of Massachusetts prohibited the operation of these traps. In order that the interests of the laboratory might not be curtailed, and the important record of the movements of fish might not be broken, the Commission in 1898 purchased one of the largest of the traps and obtained permission to operate it from the State Fisheries Commission. In the spring of 1899 a similar trap was secured for use in Vineyard Sound.

During the year the steamer *Fish Hawk* and the schooner *Grampus*, together with several steam launches and the various small boats at the station, were available for use in connection with the laboratory. The trustees of the Marine Biological Laboratory again placed their launch at the disposal of the Commission at a time when it was much needed.

An essential part of a biological laboratory is a library, and the director has taken special interest in the establishment of a creditable collection of works of reference and technical papers relating to biology. For the purpose of increasing the usefulness of the library, the Fish Commission sent circular letters to men of science, both in this country and abroad, asking them to contribute reprints of the papers they had published, or to exchange such reprints for publications of the Commission. The response to this appeal has been most gratifying, and by the close of the year the catalogue of the library contained nearly 2,000 titles. Besides a full set of the *Challenger* reports and other works from the Washington office of the Commission, the more valuable donations included a nearly complete set of Bulletins and Memoirs of the Museum of Comparative Zoology from Mr. Alexander Agassiz, and a complete series of the publications of the Prince of Monaco. During the summer of 1898, several hundred bound volumes, together with files of scientific journals, were loaned from the laboratory of Brown University. The Boston Society of Natural History also loaned works on request.

Following is a list of the persons who pursued investigations at the laboratory during the year: Frank W. Bancroft, Ph. D., Harvard University; H. G. Barber, A. B., Harvard University; C. R. Bardeen, M. D., Johns Hopkins University; John Barlow, A. M., Rhode Island Agricultural College; Edward W. Berger, A. B., Johns Hopkins University; H. C. Bumpus, Ph. D., Brown University; T. J. Burrage, A. M., Brown University; Hubert L. Clark, Ph. D., Amherst College; Wesley R. Coe, Ph. D., Yale University; Ulric Dahlgren, Ph. D., Princeton University; William H. Dudley, Wisconsin State Normal School; Alexander W. Evans, M. D., Yale University; J. W. Galloway, Harvard University; S. P. Goodhart, M. D., Columbia University; F. P. Gorham, A. M., Brown University; Caswell Grave, B. S., Johns Hopkins University; L. E. Griffin, Ph. B., Johns Hopkins University; Robert W. Hall, Ph. B., Harvard University; C. W. Hargitt, Ph. D., Syracuse University; C. Judson Herrick, Ph. D., Denison University; Roswell H. Johnson, Harvard University; J. L. Kellogg, Ph. D., Olivet College; Harry M. Kelly, A. M., Cornell College; Edwin Linton, Ph. D., Washington and Jefferson College; Albert D. Mead, Ph. D., Brown University; A. E. Ortmann, Ph. D., Princeton University; George H. Parker, Ph. D., Harvard University; William Patten, Ph. D., Dartmouth College; Raymond Pearl, Dartmouth College; C. W. Prentiss, A. M., Harvard University; Herbert W. Rand, A. B., Harvard University; Albert M. Reese, A. B., Johns Hopkins University; Porter E. Sargent, A. M., Harvard University; G. H. Sherwood, A. B., Brown University; Boris Sidis, Ph. D., Pathological Institute of the New York State Hospitals; C. F. Silvester, Princeton University; Hugh M. Smith, M. D., U. S. Fish Commission, Washington; Oliver S. Strong, Ph. D., Columbia University; Frederick H. Thompson, jr., A. B., Harvard University; Millet T. Thompson, A. B., Brown University; R. W. Tower, A. M., Brown University; E. E. Tyzzer, A. M., Brown University; Ira van Gieson, M. D., Pathological Institute of the New York State Hospitals; Herbert E. Walter, North Division High School, Chicago; F. E. Watson, A. M., Brown University; Stephen R. Williams, A. M., Harvard University.

Although the Commission places no restrictions on the problems that are selected for investigation, a very large proportion of the work is of immediate or indirect practical and economic value. Dr. Bumpus gave special attention to the rearing of newly hatched lobsters. No branch of our fisheries seems to be more in need of intelligent treatment at the present time than the lobster industry. Notwithstanding stringent protection laws and extensive fish-cultural operations, the supply of lobsters along the entire coast is steadily diminishing, and during the past three or four years has been especially limited. It is apparent that, unless active measures are taken to increase production, the animal will, in a few years, become practically exterminated. The eggs stripped from the female readily develop and hatch in McDonald jars with little loss, but the young quickly perish under the unnatural conditions in the hatchery. Therefore, the planting of the young as soon as possible after hatching has heretofore been necessary, owing to repeated failures to carry them through the early molts. If, however, the young could be artificially reared until they reach the fourth stage, when in structure and habits they are similar to the adults, they would be much more likely to flourish after their liberation, and the chances of rehabilitating the industry would be greatly improved. Before the close of the year a food was found which the young lobsters readily devour, inclosures were designed within which they seemed to flourish, and a larger number of young were carried to advanced stages of development than ever before. The problem, however, of rearing lobsters on a large scale still remains unsolved, although Dr. Bumpus believes that investigation along the lines recently followed will result in perfecting a practical method of lobster-culture.

For several years the aquaria at the station had apparently been infected with a parasitic organism which attacked the fish, produced bubbles of gas, around which the tissues wasted away, and ultimately caused death. This is not an uncommon affection in aquarium specimens. Prof. F. P. Gorham made a careful bacteriological examination of the water of the aquaria and of the tissues of the fishes, but found no organism that could be held responsible for the disease. Further observations convinced him that the condition was due to diminution in the pressure to which the fish were subjected when transferred from the deep water of the bay and sound to the shallow water of the tanks. He was able to produce and cure the disease experimentally by using small closed receptacles in which the pressure could be regulated. His observations are published in the Bulletin of the Commission for 1899.

Mr. L. E. Griffin began a study of the life-history of the squid (*Loligo pealii*), an article of great importance as bait in the commercial fisheries. The eggs of the squid are easily fertilized artificially, and the young appear to flourish in the hatchery.

The laboratory furnished Prof. C. J. Herrick with the material and facilities that enabled him to trace the origin and distribution of the cranial nerves, and Dr. Ira van Gieson was provided with material for use in elucidating certain problems relative to the structure and functions of nerve cells. While these neurological researches and other similar investigations carried on at the laboratory have no immediate bearing on the practical work of the Commission, they are nevertheless worthy of encouragement, because of their important bearing on the physiology and pathology of man; and the Commission considers it not irrelevant to its functions to thus aid in the increase of knowledge by furnishing for such inquiries a part of the wealth of marine life that is obtainable at the laboratory.

The clam industry of the northeast coast has for several years shown an unmistakably downward tendency, and, next to the lobster, the clam is perhaps the most important animal obtained in the shore fisheries now demanding consideration. An essential step preliminary to the measures for increasing the clam supply is a thorough knowledge of the breeding habits of the clam, its rate of growth, time of sexual maturity, food, enemies, etc., on all of which subjects a survey of the literature reveals a deplorable lack of information. In the summer of 1898 Prof. J. L. Kellogg was engaged by the Commission to give special attention to this subject, and he has carefully examined the clam beds in the Woods Hole region, at Essex, Mass., and in Narragansett Bay. His studies have shown among other things (1) that there is an abundance of young clams, the shores in July being literally covered; (2) that these young clams are destroyed by young star-fish, which make their advent on the shores at about the same time the clams appear; (3) that young clams are easily susceptible of artificial rearing; and (4) that their rate of growth is rapid. With these data, the Commission has undertaken artificial clam-culture on an experimental but nevertheless rather extensive scale, and the results so far obtained fully warrant the effort.

Prof. Edwin Linton, whose investigations at Woods Hole have greatly increased our knowledge of parasitology, continued his studies of the entozoa of marine fishes. The large trap operated by the Commission furnished abundant material for this work. It is important that the fish-culturist should be acquainted with the fish parasites that may invade the hatchery, but it is more important that the Commission should have a knowledge of the life-history of all animals that spend a portion of their lives in fishes and may finally infect man.

Dr. A. D. Mead pursued several important lines of inquiry. In the summer of 1898 he continued his observations on the star-fish begun at the laboratory in the spring in the interests of the Rhode Island Fish Commission. His work related especially to the habits, rate of growth, powers of regeneration, and methods of breeding of the star-fish, which ravages the oyster-beds of southern New England and New York and extends its depredations to the clam and mussel beds. A feature of these investigations, which showed a positive relation between the menhaden fishery and the oyster industry, was most instructive. That the wholesale seining of menhaden, more especially in the inshore waters, has a direct bearing on these ravages of the star-fish was not suspected until the researches of Dr. Mead, carried on at Woods Hole and in Narragansett Bay, proved beyond a doubt that the young of the star-fish, at times so abundant that they actually color the water, are the natural food of the menhaden, the schools of which form veritable living skimming-nets often a mile in breadth. This investigation indicates that it is perfectly justifiable to ascribe the rapid increase in the number of star-fish to the extensive capture of their natural enemies at a time when the latter are known to be feeding on young star-fish. Dr. Mead's very interesting report on this subject, which is printed in the annual report of the Rhode Island Commission for 1898, will appear in somewhat modified form in the Bulletin of the Commission for 1899.

In the fall of 1898 the waters of Narragansett Bay suddenly became a deep red color and emitted a very offensive odor. The fish were killed, even the hardy eels sought the shores, and dead shrimp were washed ashore in windrows. The cause of the "blood water" was entirely unknown, and Dr. Mead was engaged to investigate the matter. A species of the infusorian *Peridinium* was found to be the cause of the phenomenon. The Commission was advised that the trouble probably would be only temporary; and manufacturers, who were accustomed to pour waste dye materials into the bay and who were at first accused of causing the trouble, were exonerated.

Some very practical observations on the causes of decay in fish and the methods of arresting decay without the use of ice were made by Prof. R. W. Tower, the fish-trap providing the material necessary for the experiments. The work was undertaken by Professor Tower as the representative of the Rhode Island Fish Commission. It was shown conclusively that fish properly handled will keep absolutely fresh for 24 hours, even under the most trying climatic conditions, without the use of ice. In view of the large sums of money spent by the commercial fishermen for ice, the increased express charges on fish thus packed, and the unsatisfactory results of its use as ordinarily applied, these investigations have great importance.

The several trips of the *Grampus* in 1898, which resulted in the finding of the tile-fish in abundance off the southern New England coast, are referred to elsewhere in this report. These expeditions, however, may properly be regarded as a part of the operations of the laboratory, the vessel sailing from Woods Hole and being attended by a corps of laboratory investigators.

BEAUFORT, NORTH CAROLINA.

In conjunction with the fresh-water fish-cultural operations to be carried on at its new station at Edenton, N. C., on Albemarle Sound, the Commission contemplates the artificial propagation of the important salt-water fishes which spawn in the coastal waters of North Carolina and the other South Atlantic States. An essential preliminary to this work is the study of the habits, abundance, and distribution of the food-fishes, and also the determination of the non-economic fishes and other animals which are related to the food-fishes as food, enemies, etc. After consultation with Prof. J. A. Holmes, of the North Carolina Geological and Natural History Survey, Dr. H. V. Wilson, professor of biology in the State University, and other persons interested in the development of the fishery resources of the region, it was decided that the best place for the prosecution of marine fish-cultural operations and the conjoint scientific investigations was Beaufort harbor. The harbor and the adjacent waters teem with animals in great variety and abundance. Many naturalists have from time to time resorted to the region for the study of special problems, the advantages of the locality having been especially demonstrated by Professor Brooks and other members of Johns Hopkins University, who maintained a laboratory at Beaufort during a period of ten years.

The consensus of opinion was that the Beaufort region was not only favorable for the study of the comparatively local problems of the North Carolina waters, but also for the investigation of the fauna of the southeastern coast in general, from the combined economic and scientific standpoints. Accordingly, in May, 1899, the Commission announced that it would maintain, during the succeeding summer, at Beaufort, N. C., a laboratory for the study of questions pertaining to fish-culture, fisheries, and marine biology, and placed Prof. H. V. Wilson in charge. Beaufort is situated on Beaufort Harbor, near one of the great ocean inlets, and is reached by boat from Morehead City, the nearest railroad terminus. The use of a commodious building on the water front was acquired at a nominal rental; a suitable equipment was provided; a small working library was installed; a steam launch was assigned from another station, and on June 1 the laboratory was opened to a limited number of investigators. By the close of the year the following persons had taken tables in the laboratory, and a number of others had applied for accommodations later in the season: Dr. D. S. Johnson, Dr. Gilman A. Drew, Dr. Caswell Grave, and Mr. W. C. Coker, all of Johns Hopkins University; Prof. J. I. Hamaker, of Trinity College, N. C.; Prof. T. G. Pearson, of Guilford College, N. C.; Prof. E. W. Berger, of Baldwin University, Ohio, and Prof. H. V. Wilson, of the University of North Carolina.

The special investigations carried on at the laboratory in June included the following: Dr. Johnson and Mr. Coker studied from a systematic and œcological standpoint the marine algæ of the harbor and the flora of the banks. Dr. Drew considered the habits of the clam (*Solenomya velum*), investigated the breeding condition of the round clams (*Venus mercenaria* and *V. elevata*) and other bivalve mollusks, and reared the eggs of *Venus elevata*. Dr. Grave studied the embryology of certain ophiurans, and made a number of valuable observations on the breeding time and general life-history of other echinoderms. Professor Wilson's work included observations on the breeding condition of the sponges and of certain edible fish. All the members of the laboratory cooperated in the effort to determine the animals and plants in and near the harbor, their abundance, local distribution, breeding times, habits, etc. The foundation of a museum collection illustrating the fauna and the flora of the region was laid, and a record book was opened, in which full notes on each species observed were entered.

MISCELLANEOUS MATTERS.

Fish ova for educational purposes.—The Commission has from time to time received requests for fertilized fish eggs for use in biological courses of schools and colleges. Such eggs are very acceptable objects of study, especially during the colder months, when other material is scarce; and as they can be furnished at an inappreciable expense, the Commission has been pleased to accommodate applicants. With a view to increase the aid that might thus be given to biological work, it was decided, in the fall of 1898, to make the fact more generally known among educational institutions that living fish-eggs, in small quantities, would be supplied on request. Accordingly, a notice was published in *Science*, stating the conditions under which eggs would be sent, the stations at which they were incubated, the kinds of eggs at each station, and the season when available. A number of universities and schools took this opportunity to obtain class material.

Investigation of trout epidemic at Northville, Mich.—About the middle of October, 1898, a very disastrous epidemic broke out among the yearling brook trout (*Salvelinus fontinalis*) at the Commission's station at Northville, Mich., and continued for three months, during which time upward of 3,000 fish died, or about 32 per cent of the total number in the affected ponds. The epidemic was first investigated by Mr. M. C. Marsh; later, when it became necessary to assign Mr. Marsh to other duties, Dr. C. M. Blackford, jr., took up the inquiry.

The affected fish had been hatched in the preceding spring and were previously in good condition. The earliest symptoms of the disease are sluggish movements and inability to keep up with the other fish of the school. Later, they remain close to the bottom and are almost motionless, a slight fanning movement of the pectoral fins being the chief indication of life. As the disease progresses the gills are involved in a large proportion of cases and breathing becomes difficult, the fish going to the surface and gasping for air. The power of maintaining equilibrium is gradually lost, and the fish turns on its side, and the effort to regain the upright position may carry it past the center and cause it to roll over and over as it swims.

The characteristic lesions are effusions of blood in the subcutaneous tissues and between the muscles; and frequently, but not constantly, an inflammation of the gills leading to bulging of the opercles, and inflammation and softening of the heart and large blood vessels. The areas of extravasated blood occur upon all parts of the body, but most commonly at the bases of the fins, varying in size from a mere speck to three-fourths of an inch, larger spots sometimes being formed by the confluence of several small ones. Should the fish live long enough these effusions undergo degenerative change, with the formation of pus and an abscess cavity. In time the abscesses reach the surface and discharge, leaving a deep ulcer with pockets and sinuses extending in various directions under the skin and muscles. Changes in the blood are present, most marked in the colored corpuscles, which, instead of having the regular elliptical outline, present irregular and bizarre shapes, constituting poikilocytosis. The blood is found to be teeming with bacteria, chiefly streptococci, which appear to explain the condition of the corpuscles; the tissues and viscera also contain large numbers of bacteria.

Microscopic examination of the tissues, with the usual culture experiments, indicates that the disease is a septicæmia, caused by infection by a streptococcus. The disorganization of the blood leads to malnutrition of the tissues, followed by softening and rupture of the vessel walls and the escape of blood into the tissues. The extravasation becomes purulent, with the results stated.

The disease originated in one pond and spread thence to two other ponds into which the first pond discharged. The fact that other ponds supplied by the same (spring) water escaped the epidemic shows a local source of infection, and acquits the water of any responsibility. This was further demonstrated by a careful examination of the water. By drawing off the water in the first pond it was found that planks which formed the sides of the pond were rotten below the level of the gravel bottom of the pond, and that the cracks and softened spots therein were filled with organic débris. From cultures made from the rotting wood, and the vegetable and animal matter thereon, streptococci and staphylococci developed in great numbers, those most prevalent being *Streptococcus pyogenes*, *Staphylococcus pyogenes aureus*, and *Staphylococcus pyogenes albus*. The removal of the woodwork of the ponds and the substitution of cement or stone linings have been recommended.

Cod-tagging experiment.—The tagging of adult cod at the Woods Hole station, referred to in the last division report, was continued during the winter of 1898–99. The number of cod tagged was 593, which, with those previously liberated, make 1,155 tagged fish released in the adjacent waters. The number of tags thus far recovered from the first lot is 34; by June 30, 1899, the number returned from the second season's plant was 23. The recaptured fish furnish information regarding the movements, rate of travel, growth, etc., of the cod. The tagging will be carried on during another season.

Aquatic fauna in vicinity of hatching-stations.—The hatcheries of the Commission are annually visited by large numbers of persons, some of whom are merely sight-seers, while others are in search of information. The stations, in their respective communities, are regarded as centers of information on all matters pertaining to fishes and aquatic animals in general, in addition to purely fish-cultural subjects. In order to increase the usefulness of hatcheries in this respect arrangements are being made to provide for each station a series of labeled specimens representing all the species of fishes and other water animals found in the vicinity. As a preliminary step, this division supplied a collecting seine and preserving media to the various superintendents, some of whom have already obtained very complete collections.

Distribution of collections.—Large collections of fishes, mollusks, crustaceans, reptiles, and other objects of natural history obtained by the field assistants and vessels of the Commission have been transferred to the U. S. National Museum, in accordance with established custom. In response to requests, a number of series of fresh-water and marine fishes, preserved in alcohol, were prepared from duplicate material on hand and sent to various leading educational institutions.

Educational exhibit at Washington, D. C.—During the meeting of the National Educational Association at Washington, July 7 to 12, 1898, the various departments of the Government united in making an exhibit in the Central High School building for the information and instruction of the teachers in attendance. The main object of the exhibit was to acquaint instructors with the functions of the different Government bureaus, their methods of work, and the ways in which the results may be made available in our system of public instruction. The exhibits were largely geographical in character. The exhibit of the Fish Commission, which was installed by Dr. B. W. Evermann and Mr. M. C. Marsh, attracted much attention; it embraced the following: Samples of seines and other collecting appliances used by the Commission in its field work; thermometers, salinometers, sounding apparatus, etc.; microscopes and other laboratory instruments; apparatus used in handling eggs of different fishes propagated by the Commission and in shipping live fish and eggs; series of alcoholic fishes illustrating the species propagated; series of alcoholic fishes illustrating the geographical distribution of the genera of American fresh-water fishes; a series of aquatic invertebrates, such as are collected by the Commission and furnished by the United States National Museum to high schools and colleges for exhibition purposes; series of drawings illustrating one species in each of the more important families of North American fishes; maps showing the location of United States fish-cultural stations, the streams and lakes which have been investigated by the Commission, geographical distribution of certain important fishes; charts showing surveys made of oyster-grounds, etc., and a complete set of Fish Commission publications.

REPORT OF THE DIVISION OF STATISTICS AND METHODS OF THE FISHERIES.

By C. H. Townsend, *Assistant in charge.*

The principal work of this division for the year ending June 30, 1899, was a canvass of the fisheries of Virginia, Delaware, Maryland, and Pennsylvania. The figures collected were for the calendar year 1897. The field work in these States was commenced about the close of the last fiscal year and continued during the summer and fall. It was resumed again in the spring of 1899 and was completed by the end of the fiscal year, at which time work was also begun in New York, New Jersey, and the New England States.

The agents of the division participating in the canvass were: Messrs. W. A. Wilcox, in Virginia; C. H. Stevenson, in Maryland and New York; Ansley Hall, in Virginia, Maryland, Delaware, and New Jersey; T. M. Cogswell, in Virginia and Maryland; E. S. King, in Maryland, Delaware, and Pennsylvania; J. N. Cobb, in Maryland, Delaware Pennsylvania, and New Jersey; and W. A. Roberts, in Virginia, Maryland, and New Jersey. Mr. J. B. Wilson was temporarily employed in canvassing the fisheries of Virginia. The work in the New England States was begun in April, Messrs. Wilcox, Hall, and Cogswell canvassing Massachusetts; Messrs. Wilcox and Cogswell, New Hampshire; Mr. Cobb, Maine, and Mr. King, Rhode Island; the work is still in progress on June 30, 1899.

Mr. Stevenson, having for some time been engaged in preparing a paper on the preservation of fishery products, compiled largely from the records of the office, was sent in October and November to a number of places on the New England and Middle Atlantic coasts and the Great Lakes to procure additional information.

In the latter part of June Mr. Townsend was in the field with the statistical agents of the division engaged in canvassing the fisheries of New York, New Jersey, Rhode Island, Massachusetts, and Maine.

Mr. J. B. Wilson was employed for a time in making inquiries respecting the wholesale fishery trade of New York City, and at the close of the year was engaged in canvassing the wholesale fishery trade of Boston.

The publications appearing during the year which were wholly or in part the work of persons connected with this division were: Shad Fisheries of the Atlantic Coast of the United States, by C. H. Stevenson; Report of Fur Seal Investigations in 1896 and 1897 (Treasury document 2017, division of special agents), containing a chapter by C. H. Townsend on Pelagic Sealing; Statistics of Fisheries of the South Atlantic States; Statistics of Fisheries of the Gulf States; Notes on Foreign

Fishery Trade and Local Fisheries of Puerto Rico, by W. A. Wilcox; Preservation of Fishery Products for Food, by C. H. Stevenson.

The last contains full and detailed information respecting the various methods employed in smoking, salting, drying, canning, and otherwise preserving fish and other products of the fisheries for food. This publication will relieve the office of a vast amount of correspondence on this subject, and will be of great value to persons engaged in the fisheries.

The office continues to issue single-sheet statistical bulletins, which present in condensed form the results of the field work in advance of the regular publications of the Commission. These bulletins are widely distributed among persons engaged in the fisheries, and are also posted in custom-houses and other public offices. Those which have appeared during the year are:

No. 8.—Fisheries of the Gulf States—1897.
No. 9.—Fisheries of the South Atlantic States—1897.
No. 10.—Statement of the quantity and value of certain fishery products landed at Boston and Gloucester by American vessels during the year 1898.
No. 11.—Fisheries of Pennsylvania, Delaware, Maryland, and Virginia—1897.
No. 12.—Statement of quantities and values of fishery products recorded as landed or prepared at San Francisco, Cal., during the year 1898.

The information transmitted to the office by agents of the Commission at Boston and Gloucester has been stated on single-sheet bulletins and distributed monthly to persons engaged in the fisheries of those ports.

FISHERIES OF PUERTO RICO.

In December, 1898, Mr. William A. Wilcox sailed for Puerto Rico on the Fish Commission steamer *Fish Hawk*, and was engaged during January and February in investigating the foreign fishery trade and local fisheries of that island. His report shows that in 1897 Puerto Rico imported 34,155,983 pounds of dry, pickled, canned, and other fish, valued at $2,123,931. The value of imported fishery products was $1,325,070 in 1893; $1,649,601 in 1894; $1,987,676 in 1895; $1,815,010 in 1896. The supply of dry and pickled fish in Puerto Rico comes chiefly from Nova Scotia, with occasional cargoes from Newfoundland. The receipts of fishery products of this character in 1 97 amounted to 33,449,422 pounds from the following localities: North American British possessions, 28,048,735 pounds; United States, 4,909,141 pounds; all other countries, 491,546 pounds. This amount approximated 85 per cent of dried fish and 15 per cent of pickled fish. The proportions of dried fish by species were 90 per cent cod, 7 per cent haddock, and 3 per cent hake. Ponce is the most important place on the island in connection with the foreign fishery trade, receiving nearly half of the imports.

The report contains information relative to the character of fishery products best adapted to the climate of Puerto Rico; the customary methods followed in importing and distributing the supply, and other information relative to the conditions affecting the trade on that island. Suggestions are made on many points calculated to effect the increase of the foreign fishery trade and the importation of American fishery products as yet practically unknown there. It is believed that many of the lower-priced fishery products of the United States would find a market in Puerto Rico if cured and packed with reference to the climatic conditions prevailing there. The local fisheries were found to yield many species of edible fishes, but are not conducted very actively. The catch is mostly consumed fresh, almost no refrigeration or other methods of preservation being employed. Fishing for local use is conducted about most parts of the island.

The principal fishing appliances in use are haul seines, cast nets, trolling lines, and fish pots or traps. All appliances at present are home-made, but it is believed that there is a field for the introduction of manufactured netting. The boats in the home fisheries are all of the small size characteristic of shore fisheries. The total number of professional and semiprofessional fishermen appears to be about 800, the sail and row boats used in fishing numbering about 350. With better transportation and better facilities for refrigeration there would probably be considerable development of the local fisheries.

INSPECTION OF PRIBILOF SEAL ROOKERIES.

In July and August, 1898, Mr. Townsend made an inspection of the Pribilof Island seal rookeries, transportation having been furnished on the U. S. S. *Wheeling*, by direction of the Secretary of the Navy. It was found, by counting all of the seals born on certain rookeries during the season that the seal herd had decreased 22 per cent since 1897. Some of the smaller rookeries have been counted in this way for several years in succession, and the diminution of the herd—due to pelagic sealing—is thus quite accurately gauged. The decrease on St. George Island, where the rookeries average smaller than on St. Paul Island, was especially noticeable, and all of the seals born on that island were counted without difficulty. The total number of pup seals on St. George Island was found to be 17,826, and the number counted on six of the smaller rookeries of St. Paul Island was 13,601. As the larger rookeries diminish and become of such size that the young seals on them can be counted, they are added from time to time to the series of rookeries included in the annual counts of pups—the only class of seals readily available for enumeration.

The rate of diminution from season to season indicates that it will not be long before we shall be able to state the actual number of seals born each year. Such conditions indicate forcibly the reduced size of the herd. The number of surplus male seals killed on the Pribilof Islands under the supervision of the United States Government was 18,032. This surplus, available for killing without interfering with the breeding stock, grows smaller from year to year. For about twenty years, prior to the expansion of the pelagic sealing industry, the number of surplus males annually placed on the market was 100,000. The total pelagic catch from the American seal herd during the year was 28,142 seals. Pelagic sealing was engaged in by 35 Canadian vessels, 17,396 seals being killed in Bering Sea in waters adjacent to the

Pribilof Islands, and 10,746 in the Pacific Ocean during the northward migration of the herd.

The pelagic seal industry—based almost entirely upon the capture of breeding females—has been diminishing for several years. Although the present reduced fleet made a slightly larger catch in 1898, it was due to its having concentrated upon the American herd, the pursuit of the Asiatic herd having been practically abandoned. Upon the return of Mr. Townsend a report on the condition of the American herd as observed on the Pribilof Islands during the season was presented to the Secretary of the Treasury in compliance with the act of Congress requiring such investigations and reports by the Fish Commission.

THE WHALE FISHERY.

The American whale fishery has been declining for many years. The yield of whale products for 1898 was, however, larger than usual, the importations amounting to 12,520 barrels of sperm oil, 5,295 barrels of whale oil, and 246,120 pounds of whalebone. About 56 vessels now comprise the American fleet, 23 of which are engaged in the Pacific Ocean and 33 in the Atlantic Ocean. The fleet is credited as follows: New Bedford, 25; Provincetown, 10; Boston, 4, and San Francisco, 17.

The increase in the value of the catch in 1898 was due chiefly to the large catch of bone made by the Pacific fleet in the Arctic Ocean, where 140 bowhead whales were taken. The vessels engaged in taking sperm whales number about 17 in the Atlantic and 4 in the Pacific.

An interesting fact in connection with the yield of oil was the taking of 1,700 barrels of sea-elephant oil by the bark *Swallow*, of Boston. This vessel arrived at Kerguelen Island in December, 1897, and in three months secured about 4,000 sea elephants. The Kerguelen Island seal fishery has not been regularly prosecuted for many years, the only other vessel which has taken seals there being the *Francis Allen*, of New London, which visited the island four years prior to the *Swallow*. The larger animals taken by the *Swallow* yielded about 8 barrels of oil apiece. It is proposed to send this vessel to Kerguelen again during the coming winter.

FISHERIES OF SAN FRANCISCO.

Mr. A. B. Alexander, fishery expert of the steamer *Albatross*, was engaged during the year 1898 and for some time in 1899, in collecting monthly statistics of the yield and value of the fisheries of San Francisco. The fisheries conducted from this port yielded 39,549,639 pounds of products, valued at $7,333,244. In addition to important local fisheries, the whale fishery and most of the fisheries of Alaska are conducted from San Francisco, together with certain fisheries of Oregon and Washington.

Salmon is the leading feature of the fisheries centered at this port, the quantity landed there in 1898 from Alaska Territory, the Sacramento and other rivers being valued at $5,249,866. The products of the whale fishery were valued at $705,107. The oyster industry of San Francisco Bay, based on transplanted eastern oysters, has the third place, the quantity marketed being worth $482,604. Fur-seal pelts from the Pribilof Islands are stated at $350,000. The Chinese shrimp fishery of San Francisco Bay yielded $93,623 worth of products, and the cod fishery was worth $66,058. The sea-otter catch landed at San Francisco was valued at $30,000; this fishery, conducted off the coast of Alaska, is declining rapidly, only 154 skins being entered at the custom-house, as prescribed by law, during the year. Other important items are based on the numerous species abundant in local waters. Such species, while of very moderate value, are taken in large quantities and comprise the greater part of the fish-food supply of the city and region. Prominent among these are the introduced shad and striped bass, the catch of the former amounting to 435,718 pounds, worth only $7,841, and the latter 421,663 pounds, worth $19,707.

The following table shows by months the quantities and values of fishery products recorded as landed at San Francisco during the year, these figures not including large amounts of which no records could be found:

Statement of quantities and values of fishery products recorded as landed or prepared at San Francisco in 1898.

[Pacific coast products only. Information derived from all available sources. Large sales of products are made, of which no records are kept, and which therefore can not be enumerated.]

Species.	January.		February.		March.		April.		May.	
	Pounds.	Val.	Pounds.	Val.	Pounds.	Val.	Pounds.	Val.	Pounds.	Val.
Barracuda	....	......	21,959	$769	24,200	$887	35,200	$1,056	16,582	$532
Cat-fish	3,765	$188	6,452	280	5,490	241	7,240	354	9,433	283
Carp and chubs	29,288	205	44,397	333	46,000	375	46,758	468	2,200	17
Cultus-cod	5,866	235	5,145	180	6,820	240	5,000	150	6,574	164
Flounders	173,600	2,315	162,400	2,436	185,000	2,775	175,000	2,625	206,931	4,139
Halibut	35,346	1,274	56,400	1,316	68,400	2,400	20,400	408	40,088	802
Herring	375,500	4,224	325,500	4,883	205,000	3,075	10,000	150	....	......
King-fish	1,620	65	1,225	49	....	......	....	......	6,726	135
Mackerel	....	......	....	......	....	......	....	......	1,804	63
Perch	10,801	194	7,418	212	6,200	186	9,624	264	13,222	264
Rock-fish	32,373	906	53,133	1,275	90,000	1,984	82,460	1,649	43,508	1,523
Salmon, fresh	312,881	9,529	78,348	5,641	85,000	6,211	332,072	9,962	513,631	12,841
Sea bass	....	......	143	2	....	......	....	......	2,528	51
Shad	15,696	314	48,745	548	62,780	1,255	115,175	2,151	65,343	980
Smelt	49,627	794	17,223	723	24,629	1,046	31,840	1,273	21,467	859
Striped bass	18,206	1,529	21,060	1,770	31,215	2,559	101,400	4,416	59,752	1,793
Sturgeon	22,291	1,263	37,381	2,087	1,679	67	....	......	....	......
Tomcod	3,185	27	968	34	2,672	93	4,620	138	6,852	206
Trout	....	......	....	......	....	......	....	......	6,420	538
Oysters, native	122,500	4,375	124,500	4,625	122,000	4,066	130,000	4,876	121,200	4,545
Oysters, eastern, transplanted	1,334,000	55,025	1,329,000	49,837	1,077,000	40,387	1,024,000	38,400	816,000	30,600
Clams	111,700	2,234	119,200	2,384	102,300	2,046	108,674	2,173	101,422	2,020
Abalone, meat and shells	59,400	1,723	2,400	69	10,800	313	9,000	261	35,000	1,015
Crabs	32,520	1,788	31,260	1,720	24,560	1,351	18,724	1,123	79,920	4,795
Spiny lobster	26,775	723	16,824	505	14,874	446	20,970	629	4,330	130
Shrimp and prawn, fresh	94,000	4,700	93,250	4,662	96,600	4,830	91,842	4,592	93,000	4,650
Shrimp and prawn, dried	23,300	1,570	41,600	2,831	68,000	4,679	56,500	3,854	39,000	2,690
Terrapin	....	......	....	......	....	......	....	......	710	64
Green turtle	5,280	120	770	18	7,920	180	5,940	135	10,230	232
Miscellaneous	13,642	1,167	8,881	608	10,458	238	5,850	106	15,434	469
Total	2,913,162	96,487	2,655,582	89,797	2,379,597	81,930	2,448,289	81,213	2,339,307	76,400

Quantities and values of fishery products at San Francisco in 1898—Continued.

Species.	June.		July.		August.		September.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Barracuda	10,162	$203	15,502	$310	64,960	$984	21,536	$215
Cat-fish	6,917	208	5,689	228	2,000	66	1,457	58
Carp and chubs	1,800	14	620	6	....	....	....	....
Cultus-cod	5,780	135	8,179	164	16,616	250	11,000	220
Flounders	169,814	3,396	280,812	4,212	364,000	5,460	412,000	8,240
Halibut	46,826	1,171	52,220	1,561	37,263	1,118	35,246	793
King-fish	19,903	299	10,467	314	8,490	221	7,322	113
Mackerel	589	24	14,006	280	33,014	660	18,882	282
Perch	9,839	197	13,185	464	14,787	296	2,437	24
Rock-fish	29,854	1,594	46,546	1,629	43,552	871	47,703	1,192
Salmon, fresh	303,396	7,585	182,772	9,139	369,393	14,776	188,242	2,823
Sea bass	33,080	827	131,518	3,283	178,962	3,579	191,014	3,342
Shad	23,136	405	1,900	38	1,642	57	300	12
Smelt	9,079	454	32,078	962	29,025	1,161	40,907	1,636
Striped bass	31,511	1,163	17,707	708	7,612	304	18,764	750
Sturgeon	....	....	....	....	....	....	10,706	478
Tomcod	4,496	146	16,702	585	21,613	751	13,322	226
Trout	6,771	532	8,473	1,271	4,123	1,048	2,807	702
Oysters, native	112,000	4,100	116,000	4,350	120,000	4,500	140,000	5,250
Oysters, eastern, transpl'd	736,000	27,600	743,000	27,862	739,000	27,712	1,072,300	40,211
Clams	72,210	1,445	75,355	1,570	63,110	1,322	95,000	1,900
Abalone, meat and shells	....	....	9,000	261	13,200	383	62,600	1,815
Crabs	83,667	3,765	132,080	5,943	118,610	6,528	90,630	4,078
Spiny lobster	....	....	23,137	810	37,065	1,112	22,900	687
Shrimp and prawn, fresh	67,750	3,387	64,250	3,212	66,500	3,325	98,000	4,900
Shrimp and prawn, dried	89,200	6,042	....	....	112,000	7,750	158,100	6,227
Terrapin	510	46	2,125	191	2,725	340	2,325	415
Green turtle	8,800	200	4,950	113	5,940	135	6,380	145
Miscellaneous	20,362	444	14,511	657	17,679	756	35,242	1,005
Total	1,903,452	65,382	2,022,784	70,123	2,492,881	85,465	2,807,122	87,739

Species.	October.		November.		December.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Barracuda	18,384	$183	5,085	$127	....	....	233,570	$5,266
Cat-fish	4,432	177	3,465	138	6,419	$256	62,759	2,477
Carp and chubs	1,652	16	9,920	99	19,090	190	201,725	1,723
Cod, salted, from Alaska	....	....	....	....	....	....	1,984,600	66,058
Cultus-cod	12,000	240	8,185	245	12,641	252	103,806	2,475
Flounders	342,000	6,840	324,000	8,100	301,000	7,525	3,096,557	58,063
Halibut[a]	42,765	1,069	60,883	1,526	32,255	967	528,092	14,405
Herring	5,356	160	23,717	474	139,169	2,435	1,084,242	15,401
King-fish	6,236	93	1,545	30	2,952	42	66,486	1,361
Mackerel	624	12	....	....	....	....	68,919	1,321
Perch	4,724	118	6,104	183	8,203	205	106,544	2,607
Rock-fish	63,186	1,579	51,971	1,559	29,861	907	614,147	16,668
Salmon, fresh	76,722	1,150	238,507	9,540	302,233	12,138	2,983,197	101,335
Salmon, salted[b]	....	....	....	....	....	....	4,709,200	164,822
Salmon, smoked	....	....	....	....	....	....	45,600	6,922
Salmon, canned[c]	....	....	....	....	....	....	....	4,976,787
Sea bass	165,572	2,483	15,907	397	1,318	39	720,042	14,003
Shad	9,656	386	38,861	777	52,484	918	435,718	7,841
Smelt	74,388	2,975	33,598	2,182	9,660	676	373,521	14,741
Striped bass	39,885	1,595	56,069	2,242	18,482	878	421,663	19,707
Sturgeon	17,606	704	19,466	888	16,195	809	125,324	6,296
Tomcod	6,987	139	8,880	266	10,000	350	100,297	2.961
Trout	6,187	1,113	4,120	1,020	....	....	38,901	6,224
Oysters, native[d]	186,500	5,118	140,000	5,200	147,000	5,512	1,531,700	56,517
Oysters, eastern, transpl'd	1,184,000	44,320	1,340,000	50,250	1,344,000	50,400	12,738,300	482,604
Clams	109,000	2,180	125,537	2,511	126,948	2,540	1,210,456	24,325
Abalone, meat and shells	27,800	806	31,600	916	65,600	1,902	326,400	9,464
Crabs	119,552	4,782	148,385	5,934	150,000	6,000	1,029,908	47,807
Spiny lobster	20,907	627	18,000	564	14,640	475	220,422	6,708
Shrimp and prawn, fresh	99,000	4,950	94,000	4,700	95,500	4,775	1,053,692	52,683
Shrimp and prawn, dried[e]	53,900	1,568	12,000	773	43,200	2,956	696,800	40,940
Terrapin	2,025	397	940	232	765	202	12,125	1,887
Green turtle	7,810	178	5,720	130	3,080	70	72,820	1,656
Walrus ivory	....	....	....	....	....	....	9,510	5,231
Whalebone	....	....	....	....	....	....	206,918	620,754
Whale oil	....	....	....	....	....	....	[f] 1,003,613	26,763
Sperm oil	....	....	....	....	....	....	[g] 1,079,813	57,590
Fur-seal pelts	....	....	....	....	....	....	(h)	350,000
Sea-otter pelts	....	....	....	....	....	....	(i)	30,800
Miscellaneous	58,330	1,206	31,191	711	20,672	684	252,252	8,051
Total	2,717,186	87,164	2,857,656	101,714	2,973,367	104,103	39,549,639	7,333,244

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[a] Includes true halibut from northern waters.

[b] Includes 3,658,600 pounds from Alaska.

[c] 904,216 cases from Alaska, 26,963 from Sacramento River, and 273,902 from other sources.

[d] From Willapa Bay, Washington.

[e] Includes shrimp shells prepared for fertilizer.

[f] 133,855 gallons.

[g] 143,975 gallons.

[h] 18,032 skins. From Pribilof Islands.

[i] 154 skins. From Alaskan waters.

FISHERIES OF BOSTON AND GLOUCESTER.

The agents of the Commission stationed at these ports have made reports which show a general increase in the quantity and value of fishery products landed, the increase as compared with 1897 being 16,542,142 pounds worth $110,453. The quantity of products landed by American vessels during the year was 143,407,740 pounds, valued at $2,989,088. The total number of fares was 6,932.

The total number of fares landed at Boston was 3,491, of which 3,381 were from grounds off the New England coast and 110 from the eastern banks. The total quantity of fish landed at Boston was 54,679,570 pounds, 53,493,670 pounds being fresh and 1,185,900 pounds salted. The value of this catch was $1,041,640. There has been a decrease in the fisheries of Boston of 8,223,988 pounds and $188,404 since 1897.

Quantities and values of certain fishery products landed at Boston by American fishing vessels during 1898.

Fishing-grounds.	No. of trips.	Cod, fresh.		Cod, salted.		Cusk, fresh.		Haddock, fresh.	
		Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
East of 66° W. long.:									
La Have Bank	32	311, 500	$6, 688			122, 000	$1, 321	142, 000	$3, 178
Western Bank	27	395, 000	6, 827	25, 000	$500	113, 000	1, 183	11, 300	185
Quereau Bank	2	35, 000	1, 050						
Grand Bank	2								
Off Newfoundland	21								
Cape Shore	26	304, 000	6, 220			86, 000	1, 103	235, 000	4, 725
Total	110	1, 045, 500	20, 785	25, 000	500	321, 000	3, 607	388, 300	8, 088
West of 66° W. long.:									
Browns Bank	24	390, 500	8, 351			135, 000	1, 778	537, 500	7, 933
Georges Bank	238	2, 004, 700	37, 485	45, 000	1, 050	224, 700	2, 488	4, 250, 800	56, 657
Cashes Bank	10	94, 500	2, 016			31, 000	350	73, 000	1, 176
Clark Bank	3	22, 000	555					96, 000	1, 007
Tillies Bank	1	3, 000	60					4, 000	80
Middle Bank	364	675, 750	16, 302			260, 600	5, 930	1, 711, 500	33, 167
Jeffreys Ledge	211	404, 500	9, 556			127, 100	1, 744	888, 900	19, 266
Ipswich Bay	1	4, 000	80						
South Channel	509	4, 106, 800	88, 068			178, 200	1, 831	7, 480, 800	128, 262
Nantucket Shoals	120	1, 729, 400	29, 340			39, 600	1, 222	249, 550	4, 676
Off Highland Light	146	424, 900	9, 710			147, 000	2, 060	936, 400	16, 622
Off Chatham	83	391, 700	8, 480			84, 400	1, 045	788, 000	15, 213
Off Race Point	47	143, 400	3, 408			25, 200	295	145, 300	2, 725
Block Island	16	68, 500	1, 417					239, 100	3, 049
Shore, general	1, 608	3, 373, 350	81, 466			180, 300	1, 791	3, 980, 150	81, 023
Total	3, 381	13, 837, 000	296, 294	45, 000	1, 050	1, 433, 100	20, 534	21, 381, 000	370, 856
Grand total	3, 491	14, 882, 500	317, 079	70, 000	1, 550	1, 754, 100	24, 141	21, 769, 300	378, 944

Fishing-grounds.	Hake, fresh.		Pollock, fresh.		Halibut, fresh.		Halibut, salted.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
East of 66° W. long.:								
La Have Bank	208, 000	$1, 703	13, 500	$130	187, 900	$14, 192		
Western Bank	120, 000	941	7, 000	93	267, 700	22, 917		
Quereau Bank					5, 000	600		
Grand Bank							250, 000	$7, 650
Cape Shore	97, 000	877	14, 300	112	45, 800	4, 714		
Total	425, 000	3, 521	34, 800	335	506, 400	42, 423	250, 000	7, 650

Quantities and values of certain fishery products landed at Boston by American fishing vessels during 1898—Continued.

Fishing-grounds.	Hake, fresh.		Pollock, fresh.		Halibut, fresh.		Halibut, salted.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
West of 66° W. long.:								
Browns Bank	58,000	$672	10,000	$142	54,200	$3,296	....	....
Georges Bank	758,600	9,296	40,300	490	115,075	10,332	....	....
Cashes Bank	78,000	835	2,800	26	1,800	164	....	....
Clark Bank	29,000	315	1,000	15	200	12	....	....
Tillies Bank	2,000	10	....	....	....	....	....	....
Middle Bank	490,730	4,490	68,400	889	800	113	....	....
Jeffreys Ledge	611,700	5,508	106,400	1,115	3,900	326	....	....
South Channel	2,749,000	23,592	197,400	1,682	71,810	6,830	....	....
Nantucket Shoals	18,700	167	47,400	290	700	87	....	....
Off Highland Light	189,400	1,560	13,700	210	1,400	167	....	....
Off Chatham	203,900	1,454	29,000	354	1,300	195	....	....
Off Race Point	400	6	....	....	....	....	....	....
Block Island	66,300	483	....	....	....	....	....	....
Shore, general	1,701,700	18,626	860,900	6,107	11,000	1,188	....	....
Total	6,957,430	67,014	1,377,300	11,320	262,185	22,710	....	....
Grand total	7,382,430	70,535	1,412,100	11,655	768,585	65,133	250,000	$7,650

Fishing-grounds.	Mackerel, fresh.		Mackerel, salted.		Miscellaneous, fresh.		Miscellaneous, salted.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
East of 66° W. long.:								
La Have Bank	....	....	....	....	7,350	$295	21,000	$400
Western Bank	....	....	....	....	4,000	100	....	....
Off Newfoundland	....	....	....	....	3,775,000	64,389	400,000	5,800
Cape Shore	....	....	86,200	$4,586	....	....	5,000	100
Total	....	....	86,200	4,586	3,786,350	64,784	426,000	6,300
West of 66° W. long.:								
Georges Bank	26,900	$2,904	130,800	4,286	618,200	26,560	23,000	460
Middle Bank	....	....	....	....	500	10	....	....
Jeffreys Ledge	....	....	....	....	400	23	....	....
South Channel	2,100	128	30,000	1,275	46,200	3,020	....	....
Block Island	....	....	....	....	2,800	242	....	....
Shore, general	410,755	23,248	167,900	8,188	630,450	18,894	2,000	45
Total	439,755	26,280	328,700	13,749	1,298,550	48,749	25,000	505
Grand total	439,755	26,280	414,900	18,335	5,084,900	113,533	451,000	6,805

Fishing-grounds.	Total fresh.		Total salted.		Grand total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
East of 66° W. longitude:						
La Have Bank	992,250	$27,507	21,000	$400	1,013,250	$27,907
Western Bank	918,000	32,246	25,000	500	943,000	32,746
Quereau Bank	40,000	1,650	....	....	40,000	1,650
Grand Bank	....	....	250,000	7,650	250,000	7,650
Off Newfoundland	3,775,000	64,389	400,000	5,800	4,175,000	70,189
Cape Shore	782,100	17,751	91,200	4,686	873,300	22,437
Total	6,507,350	143,543	787,200	19,036	7,294,550	162,579
West of 66° W. longitude:						
Browns Bank	1,185,200	22,172	....	....	1,185,200	22,172
Georges Bank	8,039,275	146,212	198,800	5,796	8,238,075	152,008
Cashes Bank	281,100	4,567	....	....	281,100	4,567
Clark Bank	148,200	1,904	....	....	148,200	1,904
Tillies Bank	9,000	150	....	....	9,000	150
Middle Bank	3,208,280	60,901	....	....	3,208,280	60,901
Jeffreys Ledge	2,142,900	37,538	....	....	2,142,900	37,538
Ipswich Bay	4,000	80	....	....	4,000	80
South Channel	14,832,310	253,413	30,000	1,275	14,862,310	254,688
Nantucket Shoals	2,085,350	35,782	....	....	2,085,350	35,782
Off Highland Light	1,712,800	30,329	....	....	1,712,800	30,329
Off Chatham	1,498,300	26,741	....	....	1,498,300	26,741
Off Race Point	314,300	6,434	....	....	314,300	6,434
Block Island	376,700	5,191	....	....	376,700	5,191
Shore, general	11,148,605	232,343	169,900	8,233	11,318,505	240,576
Total	46,986,320	863,757	398,700	15,304	47,385,020	879,061
Grand total	53,493,670	1,007,300	1,185,900	34,340	54,679,570	1,041,640

The fish landed at Gloucester amounted to 88,724,170 pounds, valued at $1,947,448. Of the total quantity, 54,386,779 pounds were fresh and 34,337,371 pounds salted. 3,441 trips were landed at Gloucester, an increase of 1,050 trips since 1897. 2,588 trips were landed from grounds off the New England coast and 853 from the eastern grounds. There has been an increase in the fisheries of this port of 24,762,130 pounds, and an increase in value of $298,857. During the year the fresh-fish industry of Gloucester increased 21,426,538 pounds over the amount landed in 1897, the increase in value amounting to $249,101.

Quantities and values of certain fishery products landed at Gloucester by American fishing vessels during 1898.

Fishing-grounds.	No. of trips	Cod, fresh.		Cod, salted.		Cusk, fresh.		Cusk, salted.	
		Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value
East of 66° W. long.:									
La Have Bank	281	5, 337, 544	$81, 880	458, 086	$13, 451	1, 174, 271	$12, 898		
Western Bank	188	5, 195, 269	75, 197	4, 150, 583	113, 704	187, 540	2, 167	2, 000	$45
Quereau Bank	103			344, 085	9, 727				
Green Bank	14			25, 000	813				
Grand Bank	64			11, 232, 940	220, 346				
St. Peters Bank	6			27, 000	878				
Bacalieu Bank	80			25, 000	750				
Off Newfoundland	48			53, 207	1, 698				
Cape North	7			287, 960	6, 861				
Cape Shore	51	349, 565	5, 463	118, 800	3, 486	2, 760	32	11, 000	248
Gulf of St. Lawrence	11								
Total	853	10, 882, 378	162, 540	16, 722, 661	371, 714	1, 364, 571	15, 097	13, 000	293
West of 66° W. long.:									
Browns Bank	5	31, 669	395	20, 500	709	75, 890	974	14, 000	310
Georges Bank	579	1, 659, 210	36, 156	6, 949, 426	225, 379	153, 426	1, 863	80, 190	1, 792
Cashes Bank	178	1, 894, 440	27, 447	25, 000	788	1, 278, 951	14, 827		
Middle Bank	31	104, 756	2, 556			42, 733	474		
Jeffreys Ledge	98	382, 764	8, 002			117, 349	1, 304		
Ipswich Bay	8	51, 255	843						
South Channel	1								
Nantucket Shoals	81	110, 578	1, 380	2, 616, 434	66, 021				
Off Chatham	10	7, 655	94						
Block Island	44								
Shore, general	1, 553	1, 667, 300	40, 459	82, 000	2, 208	131, 013	1, 531		
Total	2, 588	5, 909, 627	117, 332	9, 693, 360	295, 105	1, 799, 362	20, 973	94, 190	2, 102
Grand total	3, 441	16, 792, 005	279, 872	26, 416, 021	666, 819	3, 163, 933	36, 070	107, 190	2, 395

Fishing-grounds.	Pollock, fresh.		Pollock, salted.		Halibut, fresh.		Halibut, salted.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
East of 66° W. long.:								
La Have Bank	111, 243	$711			666, 611	$47, 571		
Western Bank	72, 615	445			238, 085	19, 798	4, 000	$140
Quereau Bank					2, 078, 908	148, 604		
Green Bank					241, 239	13, 702		
Grand Bank					147, 827	8, 139	90, 165	3, 215
St. Peters Bank					140, 105	6, 055		
Bacalieu Bank					2, 930, 274	134, 799	1, 650, 000	52, 875
Off Newfoundland					316, 495	14, 115		
Cape North					173, 633	6, 307		
Cape Shore	280	2			1, 600	144		
Total	184, 138	1, 158			6, 934, 777	399, 234	1, 744, 165	56, 230
West of 66° W. long.:								
Browns Bank	3, 604	22			24, 172	1, 591		
Georges Bank	49, 586	349			647, 182	47, 857	3, 000	105
Cashes Bank	163, 530	901			6, 200	573		
Middle Bank	4, 630	38						
Jeffreys Ledge	8, 149	65			100	9		
Ipswich Bay	1, 200	7						
Nantucket Shoals	6, 356	31						
Off Chatham	377, 985	2, 349	20, 000	$250				
Shore, general	2, 252, 961	13, 358						
Total	2, 868, 001	17, 120	20, 000	250	677, 654	50, 030	3, 000	105
Grand total	3, 052, 139	18, 278	20, 000	250	7, 612, 431	449, 264	1, 747, 165	56, 335

Quantities and values of certain fishery products landed at Gloucester, etc.—Continued.

Fishing-grounds.	Haddock, fresh.		Haddock, salted.		Hake, fresh.		Hake, salted.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
East of 66° W. long.:								
La Have Bank	4, 216, 192	$39, 438	....	....	2, 798, 368	$20, 267	....	....
Western Bank	353, 475	4, 227	22, 000	$275	839, 261	6, 138	....	....
Cape Shore	60, 512	1, 374	....	....	31, 510	252	16, 000	$200
Total	4, 630, 179	45, 039	22, 000	275	3, 669, 139	26, 657	16, 000	200
West of 66° W. long.:								
Browns Bank	5, 723	33	....	....	23, 733	196	....	....
Georges Bank	4, 039, 335	53, 887	....	....	200, 712	2, 876	....	....
Cashes Bank	882, 394	6, 098	....	....	4, 918, 783	33, 270	....	....
Middle Bank	172, 293	2, 657	....	....	53, 629	617	....	....
Jeffreys Ledge	423, 918	5, 735	....	....	329, 205	2, 888	....	....
Ipswich Bay	850	9	....	....	....	....	....	....
Nantucket Shoals	3, 764	21	14, 820	164	550	3	2, 800	30
Shore, general	554, 167	10, 911	....	....	923, 392	7, 474	....	....
Total	6, 082, 444	79, 351	14, 820	164	6, 450, 004	47, 324	2, 800	30
Grand total	10, 712, 623	124, 390	36, 820	439	10, 119, 143	73, 981	18, 800	230

Fishing-grounds.	Mackerel, fresh.		Mackerel, salted.		Other fish, fresh.		Other fish, salted.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
East of 66° W. long.:								
La Have Bank	....	....	....	....	1, 027	$26		
Off Newfoundland	....	....	....	....	2, 382, 875	40, 531	4, 023, 975	$61, 519
Cape Shore	3, 600	$220	610, 200	$36, 446	....	....	....	....
Gulf of St. Lawrence	....	....	77, 400	9, 870	....	....	....	....
Total	3, 600	220	687, 600	46, 316	2, 383, 902	40, 557	4, 023, 975	61, 519
West of 66° W. long.:								
Georges Bank	172, 800	10, 496	317, 600	16, 017	79, 906	2, 184	....	....
Cashes Bank	....	....	....	....	29, 480	2, 358	....	....
Jeffreys Ledge	....	....	....	....	5, 237	419	....	....
South Channel	....	....	....	....	2, 000	100	....	....
Block Island	21, 600	1, 258	283, 000	16, 722	....	....	....	....
Shore, general	236, 000	15, 090	518, 600	22, 962	....	....	160, 600	2, 907
Total	430, 400	26, 844	1, 119, 200	55, 701	116, 623	5, 061	160, 600	2, 907
Grand total	434, 000	27, 064	1, 806, 800	102, 017	2, 500, 525	45, 618	4, 184, 575	64, 426

Fishing-grounds.	Total, fresh.		Total, salted.		Grand total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
East of 66° W. long.:						
La Have Bank	14, 305, 256	$202, 791	458, 086	$13, 451	14, 763, 342	$216, 242
Western Bank	6, 886, 245	107, 972	4, 178, 583	114, 164	11, 064, 828	222, 136
Quereau Bank	2, 078, 908	148, 604	344, 085	9, 727	2, 422, 993	158, 331
Green Bank	241, 239	13, 702	25, 000	813	266, 239	14, 515
Grand Bank	147, 827	8, 139	11, 323, 105	223, 561	11, 470, 932	231, 700
St. Peters Bank	140, 105	6, 055	27, 000	878	167, 105	6, 933
Bacalieu Bank	2, 930, 274	134, 799	1, 675, 000	53, 625	4, 605, 274	188, 424
Off Newfoundland	2, 699, 370	54, 646	4, 077, 182	63, 217	6, 776, 552	117, 863
Cape North	173, 633	6, 307	287, 960	6, 861	461, 593	13, 168
Cape Shore	449, 827	7, 487	756, 000	40, 380	1, 205, 827	47, 867
Gulf of St. Lawrence	....	....	77, 400	9, 870	77, 400	9, 870
Total	30, 052, 684	690, 502	23, 229, 401	536, 547	53, 282, 085	1, 227, 049
West of 66° W. long.:						
Browns Bank	164, 791	3, 211	34, 500	1, 019	199, 291	4, 230
Georges Bank	7, 002, 157	155, 668	7, 350, 216	243, 293	14, 352, 373	398, 961
Cashes Bank	9, 173, 778	85, 474	25, 000	788	9, 198, 778	86, 262
Middle Bank	378, 041	6, 342	....	....	378, 041	6, 342
Jeffreys Ledge	1, 266, 722	18, 422	....	....	1, 266, 722	18, 422
Ipswich Bay	53, 305	859	....	....	53, 305	859
South Channel	2, 000	100	....	....	2, 000	100
Nantucket Shoals	121, 248	1, 435	2, 634, 054	66, 215	2, 755, 302	67, 650
Off Chatham	385, 640	2, 443	20, 000	250	405, 640	2, 693
Block Island	21, 600	1, 258	283, 000	16, 722	304, 600	17, 980
Shore, general	5, 764, 833	88, 823	761, 200	28, 077	6, 526, 033	116, 900
Total	24, 334, 115	364, 035	11, 107, 970	356, 364	35, 442, 085	720, 399
Grand total	54, 386, 799	1, 054, 537	34, 337, 371	892, 911	88, 724, 170	1, 947, 448

The following table shows, by months, the quantity and value of fish landed at Boston and Gloucester during the year 1898, and is chiefly interesting as showing the regularity with which the great fishery based on halibut and species of the cod family is conducted during the different seasons of the year:

Statement by months of quantities and values of certain fishery products landed at Boston and Gloucester by American fishing vessels during 1898.

Months.	No. of trips.	Cod, fresh.		Cod, salted.		Cusk, fresh.		Cusk, salted.		Haddock, fresh.	
		Pounds.	Value.	Pounds.	Value.	Pounds.	Val.	Lbs.	Val.	Pounds.	Value.
Boston:											
January	205	601, 200	$13, 292	....	......	20, 000	$256	....	.....	1, 464, 500	$22, 707
February	257	880, 400	23, 484	....	......	64, 000	710	....	.....	2, 445, 200	39, 868
March	399	1, 921, 500	36, 023	....	......	127, 400	1, 437	....	.....	4, 073, 600	47, 590
April	296	1, 119, 700	22, 181	....	......	201, 000	2, 045	....	.....	1, 608, 800	32, 091
May	338	1, 301, 100	20, 354	....	......	573, 900	8, 009	....	.....	1, 200, 350	15, 469
June	252	1, 314, 050	30, 097	....	......	291, 600	6, 350	....	.....	1, 031, 300	21, 101
July	275	1, 763, 800	29, 793	....	......	34, 500	356	....	.....	1, 802, 650	24, 423
August	291	1, 630, 500	30, 702	25, 000	$500	25, 000	290	....	.....	2, 281, 400	34. 069
September	244	1, 282, 600	32, 855	....	......	125, 400	1, 276	....	.....	1, 890, 300	37, 516
October	352	1, 440, 100	36, 360	....	......	98, 400	1, 051	....	.....	1, 905, 300	41, 708
November	368	988, 850	21, 150	....	......	128, 800	1, 306	....	.....	1, 431, 400	37. 107
December	214	638, 700	20, 788	45, 000	1, 050	64, 100	1, 055	....	.....	634, 500	25, 295
Total	3, 491	14, 882, 500	317, 079	70, 000	1, 550	1, 754, 100	24, 141	....	.....	21, 769, 300	378, 944
Gloucester:											
January	377	1, 264, 155	28, 510	298, 100	9, 761	231, 700	2, 543	....	.....	2, 571, 500	28, 636
February	350	1, 172, 511	26, 324	490, 120	15, 950	259, 800	2, 818	....	.....	2, 088, 600	24, 046
March	331	2, 821, 413	40, 822	1, 266, 975	41, 480	295, 385	3, 200	....	.....	3, 166, 106	24, 620
April	194	2, 801, 133	32, 733	464, 329	14, 383	238, 718	2, 597	12, 000	$270	391, 507	2, 804
May	226	1, 130, 385	17, 013	1, 312, 669	39, 817	478, 613	5, 951	11, 000	234	395, 823	3, 349
June	309	906, 867	14, 552	2, 713, 712	73, 346	603, 653	7, 011	16, 000	356	255, 231	1, 763
July	302	866, 478	10, 725	6, 364, 560	130, 316	382, 518	4, 178	35, 690	803	284, 417	1, 447
August	228	1, 433, 248	19, 205	2, 714, 236	65, 856	127, 019	1, 271	21, 500	484	105, 772	708
September	205	1, 347, 413	21, 280	2, 497, 717	68, 810	123, 592	1, 407	....	.....	115, 911	817
October	317	1, 175, 632	23, 501	2, 704, 931	72, 022	175, 304	2, 017	11, 000	248	223, 276	3, 601
November	391	1, 164, 446	21, 995	5, 021, 480	117, 807	167, 396	1, 947	....	.....	440, 516	8, 670
December	211	708, 324	23, 212	567, 192	17, 271	80, 235	1, 130	....	.....	710, 784	24, 368
Total	3, 441	16, 792, 005	279, 872	26, 416, 021	666, 819	3, 163, 933	36, 070	107, 190	2, 395	10, 749, 443	124, 829
Grand total	6, 932	31, 674, 505	596, 951	26, 486, 021	668, 369	4, 918, 033	60, 211	107, 190	2, 395	32, 518, 743	503, 773

Months.	Hake, fresh.		Pollock, fresh.		Halibut, fresh.		Halibut, salted.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Boston:								
January	291, 300	$3, 233	33, 500	$688	5, 125	$721	....	....
February	416, 430	5, 891	25, 500	479	19, 100	2, 068	....	....
March	304, 000	3, 942	36, 000	550	139, 700	9, 480	....	....
April	333, 200	3, 810	84, 300	619	149, 900	14, 128	....	....
May	190, 700	1, 905	377, 700	1, 953	170, 100	12, 423	....	....
June	503, 100	4, 932	188, 000	1, 021	83, 200	5, 285	....	....
July	393, 100	3, 063	62, 900	421	78, 300	5, 567	....	....
August	474, 000	4, 326	128, 000	1, 207	22, 780	1, 849	....	....
September	828, 400	8, 231	143, 100	1, 699	22, 060	3, 019	250, 000	$7, 650
October	1, 817, 700	11, 851	168, 600	1, 338	24, 500	3, 623	....	....
November	1, 401, 300	9, 627	147, 000	1, 385	11, 850	1, 591	....	....
December	429, 200	9, 724	17, 500	295	41, 970	5, 379	....	....
Total	7, 382, 430	70, 535	1, 412, 100	11, 655	768, 585	65, 133	250, 000	7, 650
Gloucester:								
January	326, 000	3, 139	....	....	545, 891	40, 696	....	....
February	225, 000	2, 355	....	....	657, 995	47, 771	....	....
March	259, 717	2, 633	60, 369	516	970, 293	55, 142	....	....
April	474, 170	4, 213	58, 550	374	601, 199	44, 825	....	....
May	1, 045, 234	8, 619	556, 428	3, 432	505, 135	31, 055	....	....
June	1, 913, 437	14, 383	208, 712	1, 372	577, 952	22, 893	7, 000	245
July	1, 929, 894	10, 452	104, 622	541	1, 147, 138	49, 106	48, 630	1, 755
August	748, 394	3, 765	32, 869	182	944, 528	47, 741	8, 465	286
September	1, 173, 197	7, 799	80, 581	485	766, 548	35, 037	1, 652, 000	52, 940
October	1, 223, 638	8, 974	892, 151	5, 348	392, 156	31, 220	4, 500	146
November	665, 286	4, 708	1, 044, 019	5, 895	359, 831	30, 619	26, 570	963
December	153, 976	3, 171	33, 838	383	143, 765	13, 159	....	....
Total	10, 137, 943	74, 211	3, 072, 139	18, 528	7, 612, 431	449, 264	1, 747, 165	56, 335
Grand total	17, 520, 373	144, 746	4, 484, 239	30, 183	8, 381, 016	514, 397	1, 997, 165	63, 985

Statement by months of quantities and values of certain fishery products landed at Boston and Gloucester—Continued.

Months.	Mackerel, fresh.		Mackerel, salted.		Other fish, fresh.*		Other fish, salted.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Boston:								
January	....	....	....	....	1,635,000	$29,475	....	....
February	....	....	....	....	2,020,000	33,114	....	....
March	....	....	....	....	121,000	1,820	....	....
April	....	....	....	....	....	....	8,000	$160
May	500	$60	....	....	....	....	21,000	430
June	238,187	12,500	209,000	$10,404	21,750	503	....	....
July	92,081	8,024	166,000	5,776	438,050	15,971	201,000	2,900
August	20,067	1,482	31,600	1,672	353,700	15,538	....	....
September	53,050	3,758	500	60	148,600	12,473	....	....
October	18,620	226	3,600	108	138,950	2,070	....	....
November	17,250	230	4,200	315	207,850	2,569	1,000	15
December	....	....	....	....	....	....	220,000	3,300
Total	439,755	26,280	414,900	18,335	5,084,900	113,533	451,000	6,805
Gloucester:								
January	....	....	....	....	994,500	9,441	761,625	10,150
February	....	....	....	....	510,750	10,227	15,750	210
March	....	....	....	....	337,625	3,763	324,000	4,320
June	186,320	11,246	1,076,000	53,282	....	....	....	....
July	189,000	11,310	496,000	25,118	61,532	1,230	....	....
August	57,420	4,420	40,200	2,621	47,118	3,137	....	....
September	1,260	88	48,800	4,631	9,000	720	52,000	813
October	....	....	86,200	9,551	....	....	98,600	1,944
November	....	....	57,800	6,589	300,000	8,700	1,910,000	31,025
December	....	....	1,800	225	240,000	8,400	1,022,600	15,964
Total	434,000	27,064	1,806,800	102,017	2,500,525	45,618	4,184,575	64,426
Grand total	873,755	53,344	2,221,700	120,352	7,585,425	159,151	4,635,575	71,231

Months.	Total, fresh.		Total, salted.		Grand total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Boston:						
January	4,050,625	$70,372	....	....	4,050,625	$70,372
February	5,870,630	105,614	....	....	5,870,630	105,614
March	6,723,200	100,842	....	....	6,723,200	100,842
April	3,496,900	74,874	8,000	$160	3,504,900	75,034
May	3,814,350	60,173	21,000	430	3,835,350	60,603
June	3,671,187	81,789	209,000	10,404	3,880,187	92,193
July	4,665,381	87,618	367,000	8,676	5,032,381	96,294
August	4,935,447	89,463	56,600	2,172	4,992,047	91,635
September	4,493,510	100,827	250,500	7,710	4,744,010	108,537
October	5,612,170	98,227	3,600	108	5,615,770	98,335
November	4,334,300	74,965	5,200	330	4,339,500	75,295
December	1,825,970	62,536	265,000	4,350	2,090,970	66,886
Total	53,493,670	1,007,300	1,185,900	34,340	54,679,570	1,041,640
Gloucester:						
January	5,933,746	112,965	1,059,725	19,911	6,993,471	132,876
February	4,914,656	113,541	505,870	16,160	5,420,526	129,701
March	7,910,908	130,696	1,590,975	45,800	9,501,883	176,496
April	4,565,277	87,546	476,329	14,653	5,041,606	102,199
May	4,111,618	69,419	1,323,669	40,051	5,435,287	109,470
June	4,652,172	73,220	3,812,712	127,229	8,464,884	200,449
July	4,965,599	88,989	6,944,880	157,992	11,910,479	246,981
August	3,496,368	80,429	2,784,401	69,247	6,280,769	149,676
September	3,617,502	67,633	4,450,517	127,194	7,868,019	194,827
October	4,082,157	74,661	2,905,231	83,911	6,987,388	158,572
November	4,141,494	82,534	7,015,850	156,384	11,157,344	238,918
December	2,070,922	73,823	1,591,592	33,460	3,662,514	107,283
Total	†54,462,419	1,055,456	34,261,751	891,992	88,724,170	1,947,448
Grand total	107,956,089	2,062,756	35,447,651	926,332	143,407,740	2,989,088

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*Includes herring from Newfoundland; 6,137.875 pounds frozen, $101,420, and 4,243,975 pounds salted, $64,519.

†Includes 75,620 pounds salted haddock, hake, and pollock, $919.

THE FISHERIES OF THE MIDDLE ATLANTIC STATES.

The fishery canvass of Pennsylvania, Delaware, Maryland, and Virginia having been completed in advance of the other States of the Middle Atlantic region, a condensed statement respecting their fisheries in 1897 was prepared and distributed as Statistical Bulletin No. 11.

There were employed in the fisheries of New York 7,443 persons; in those of New Jersey, 12,494; Pennsylvania, 1,898; Delaware, 2,392; Maryland, 42,812, and Virginia, 28,277. The fisheries of Pennsylvania in the present canvass include, however, only those of the Delaware and Susquehanna rivers.

The total investment in the fisheries of all these States was $15,188,614. The total number of vessels employed was 3,874, valued with their outfits at $4,167,469.

Gill nets were the most extensively used among the different forms of apparatus, with the exception of oyster tongs, 26,242 being the total number.

The total number of pound and trap nets was 2,491, valued at $499,115.

In respect to products of the fisheries, Maryland leads, the value being $3,617,306. The fishery products of New Jersey were worth $3,614,434; those of New York, $3,391,595; those of Virginia, $3,167,863; those of Pennsylvania, $269,507, and those of Delaware, $252,123. The products of the fisheries of all these States amounted to 593,992,516 pounds, valued at $14,312,828.

Taking these States as a whole, the oyster fishery leads all others in importance, being valued at $8,866,829. The shad fishery ranks next, with a value of $980,748. The products of the clam fishery were valued at $937,872. Other important fisheries are for blue-fish and menhaden, the former being worth $581,560 and the latter $473,359.

The value of the fisheries in general for 1897 when compared with that for 1891—the year of the last preceding investigation—shows a decrease of $4,710,646, due chiefly to a falling off in the oyster industry in Maryland, Virginia, and New York, but principally in Maryland.

There has been an important increase in the yield of the shad fishery in general, accompanied by a noticeable decrease in value. Virginia is the only State in which an increase in value is shown.

In the menhaden fishery there is shown an increase in the yield and a decrease in value.

The sturgeon fishery has decreased somewhat in yield, while the value has materially increased.

Fisheries of the Middle Atlantic States in 1897.

Items.	New York.		New Jersey.		Pennsylvania.		Delaware.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Persons employed	7,443		12,494		1,898		2,392	
Vessels and outfits	643	$1,011,650	675	$766,844	40	$91,755	42	$37,854
Boats	4,119	274,341	6,365	485,059	504	21,485	953	39,349
Seines	179	26,810	604	45,072	125	12,921	176	8,676
Gill nets	3,169	65,187	4,142	124,158	177	9,711	983	31,037
Pound nets, trap nets, and weirs	197	53,780	180	98,995			8	625
Dredges	2,536	14,926	1,587	33,759	83	2,500	72	2,880
Tongs and rakes	3,634	17,732	8,815	50,819			117	845
Other apparatus		35,013		29,154		2,480		1,979
Shore property		437,930		563,992		828,576		196,374
Cash capital		157,500		173,400		632,100		88,200
Total investment		2,094,869		2,371,252		1,601,528		407,819

Products.	New York.		New Jersey.		Pennsylvania.		Delaware.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	955,000	$11,367	2,053,802	$9,529	422,335	$2,883	1,924,607	$11,910
Black bass			150	12	4,103	418		
Blue-fish	11,146,424	391,027	5,164,173	148,257	12,800	321		
Bonito	42,823	2,103	358,700	9,605				
Butter-fish	728,616	26,125	217,057	5,867				
Carp	205,560	8,318	785,409	39,370	114,950	6,695	111,300	5,192
Cat-fish	90,090	5,656	221,985	11,114	120,096	6,985	68,290	3,847
Cod	2,116,316	69,879	3,481,890	71,208				
Croakers			280,800	5,021			297,600	2,554
Eels	420,730	29,226	749,405	35,862	51,794	4,273	128,810	6,352
Flounders	1,108,057	35,174	1,225,725	29,018	31,545	792	2,000	85
Haddock	153,320	4,904	167,375	3,060				
Hake	24,300	608	69,735	1,538				
King-fish	10,440	872	43,027	3,766				
Mackerel	140,812	6,978	24,300	1,628				
Menhaden	60,605,712	147,697	30,552,825	70,056				
Mullet			22,075	537			37,700	844
Perch	65,590	3,365	602,877	38,221			399,300	19,128
Pike			2,770	152			41,250	2,027
Pompano			40	10				
Scup	746,373	16,911	757,450	13,816	29,150	719		
Sea bass	354,441	16,245	2,131,480	74,281	900,000	36,000	1,900	95
Shad	1,884,228	62,953	13,000,783	342,931	2,007,325	63,587	1,620,364	47,962
Sheepshead	4,900	252	49,835	8,565				
Snappers, red	92,000	3,680						
Spanish mackerel	11,360	1,825	108,030	11,539				
Spots			20,700	682				
Squeteague	2,561,527	69,474	8,679,132	180,989			1,440,880	25,149
Striped bass	116,465	14,177	287,189	31,978	9,556	991	128,770	12,033
Sturgeon	427,547	26,248	813,449	26,464	9,945	260	467,250	9,014
Suckers	16,050	635	142,130	6,720	25,250	1,244	35,200	1,543
Tautog	49,181	1,534	289,400	5,513			4,800	240
Other fish	1,200,200	3,638	125,841	2,626	1,952	173		
Caviar			200,155	67,592			69,479	25,736
Crabs	413,180	5,975	795,301	40,069			168,800	5,389
King crabs			1,124,800	4,495			675,000	2,025
Lobsters	381,020	31,458	99,230	8,573			5,095	459
Clams	2,219,304	253,883	5,475,177	607,520			6,800	1,530
Oysters	14,887,040	2,050,658	21,035,341	1,682,015	1,861,538	143,974	1,146,390	63,897
Scallops	885,960	80,122	72,000	4,000				
Terrapin			13,528	6,096	825	98	8,322	2,556
Turtles			14,550	999	1,021	78	44,570	2,396
Other products	5,491,000	9,228	2,522,896	3,140	78	16	320	160
Total	109,555,566	3,391,595	103,782,517	3,614,434	5,604,263	269,507	8,834,797	252,123

Fisheries of the Middle Atlantic States in 1897—Continued.

Items.	Maryland.		Virginia.		Total for Middle Atlantic States.	
	No.	Value.	No.	Value.	No.	Value.
Persons employed	42, 812		28, 277		95, 316	
Vessels and outfits	1, 419	$1, 344, 542	1, 055	$914, 824	3, 874	$4, 167, 469
Boats	10, 077	562, 455	10, 302	493, 276	32, 320	1, 875, 965
Seines	330	39, 282	145	54, 012	1, 559	186, 773
Gill nets	8, 464	77, 264	9, 307	46, 235	26, 242	253, 592
Pound nets, trap nets, and weirs	856	81, 115	1, 250	264, 600	2, 491	499, 115
Dredges	8, 520	99, 111	1, 816	22, 767	14, 614	175, 943
Tongs and rakes	11, 191	66, 647	13, 552	55, 100	37, 309	191, 143
Other apparatus		32, 240		8, 290		109, 156
Shore property		1, 878, 669		607, 682		4, 513, 223
Cash capital		1, 640, 285		424, 750		3, 116, 235
Total investment		5, 821, 610		2, 891, 536		15, 188, 614

Products.	Maryland.		Virginia.		Total for Middle Atlantic States.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	17, 139, 459	$123, 453	13, 675, 585	$70, 653	36, 170, 788	$229, 795
Black bass	6, 765	613	13, 600	630	24, 618	1, 673
Blue-fish	186, 708	7, 156	1, 505, 128	34, 799	18, 015, 233	581, 560
Bonito	1, 000	50	25, 350	798	427, 873	12, 556
Butter-fish	87, 040	2, 348	465, 828	10, 624	1, 498, 541	44, 964
Carp	110, 925	3, 825	3, 194	108	1, 331, 338	63, 508
Cat-fish	578, 021	19, 644	381, 392	10, 526	1, 459, 874	57, 772
Cod			800	40	5, 599, 006	141, 127
Croakers	236, 295	2, 889	4, 111, 929	27, 208	4, 926, 624	37, 672
Eels	406, 744	14, 684	76, 565	2, 529	1, 834, 048	92, 926
Flounders	27, 357	1, 097	230, 440	6, 552	2, 625, 124	72, 718
Haddock					320, 695	7, 964
Hake					94, 035	2, 146
King-fish	1, 000	35	120, 075	4, 970	174, 542	9, 643
Mackerel			300	18	165, 412	8, 624
Menhaden	353, 100	365	178, 656, 362	255, 241	270, 167, 999	473, 359
Mullet	1, 500	60	54, 521	1, 196	115, 796	2, 637
Perch	1, 321, 280	62, 246	337, 629	14, 672	2, 726, 676	137, 632
Pike	114, 710	8, 919	29, 625	2, 360	188, 355	13, 458
Pompano	310	35	70, 135	5, 515	70, 485	5, 560
Scup			4, 000	120	1, 536, 973	31, 566
Sea bass	16. 200	690	1, 765	40	3, 405, 786	127, 351
Shad	5, 799, 563	159, 365	11, 513, 994	303, 950	35, 826, 257	980, 748
Sheepshead	200	12	28, 818	1, 894	83, 753	10, 723
Snappers, red					92, 000	3, 680
Spanish mackerel	9, 762	833	503, 106	39, 911	632, 258	54, 108
Spots	2, 928	139	1, 079, 492	26, 467	1, 103, 120	27, 288
Squeteague	597, 179	14, 792	6, 474, 946	88, 901	19, 753, 664	379, 305
Striped bass	935, 347	70, 045	544, 237	32, 429	2, 021, 564	161, 653
Sturgeon	145, 569	5, 008	631, 619	16, 563	2, 495, 379	83, 557
Suckers	83, 030	1, 801	51, 250	1, 762	352, 910	13, 705
Tautog					343, 381	7, 287
Other fish	51, 752	641	494, 020	9, 050	1, 873, 765	16, 128
Caviar	1, 594	644	63, 960	19, 023	335, 188	112, 995
Crabs	9, 449, 195	217, 586	6, 399, 514	68, 245	17, 225, 990	337, 264
King crabs					1, 799, 800	6, 520
Lobsters					485, 345	40, 490
Clams	122, 288	8, 842	841, 568	66, 097	8, 665, 137	937, 872
Oysters	50, 784, 538	2, 885, 202	49, 166, 936	2, 041, 683	138, 881. 783	8, 866, 829
Scallops					957, 960	84, 122
Terrapin	7, 266	3, 226	11, 822	2, 104	41, 763	14, 080
Turtles	5, 465	289	56, 825	1, 077	122, 431	4, 839
Other products	3, 928	772	1, 025	108	8, 019, 247	13, 424
Total	88, 588, 018	3, 617, 306	277, 627, 355	3, 167, 863	593, 992, 516	14, 312, 828

THE FISHERIES OF NEW YORK AND NEW JERSEY.

In addition to the data presented in the foregoing tables for 1897, the following statistics on the fisheries of New York and New Jersey have also been secured:

Fisheries of New York and New Jersey in 1898.

Items.	New York.		New Jersey.	
	Number.	Value.	Number.	Value.
Persons employed	9, 185		12, 270	
Vessels, fishing	501	$940, 415	531	$465, 875
Tonnage	9, 258		5, 564	
Outfit		256, 486		92, 161
Vessels, transporting	166	143, 395	117	168, 775
Tonnage	2, 365		2, 019	
Outfit		9, 789		19, 764
Boats, scows, and floats	3, 998	264, 792	6, 424	483, 889
Seines	229	48, 090	610	43, 730
Gill nets	2, 939	63, 689	4, 304	127, 742
Pound nets and weirs	195	55, 385	172	88, 885
Fyke nets	3, 531	16, 016	2, 835	18, 470
Lines		7, 012		7, 439
Pots, lobster and eel	9, 729	12, 092	4, 700	5, 362
Dredges, tongs, and rakes	5, 343	30, 948	10, 544	87, 745
Other apparatus		457		737
Shore property		2, 760, 421		561, 048
Cash capital		2, 980, 800		165, 800
Total investment		7, 589, 787		2, 337, 422

Species.	New York.		New Jersey.	
	Pounds.	Value.	Pounds.	Value.
Alewives	1, 028, 110	$12, 652	1, 609, 947	$8, 707
Blue fish	11, 214, 433	387, 167	5, 077, 085	163, 620
Bonito	63, 244	1, 718	376, 822	9, 943
Butter-fish	470, 836	15, 488	262, 627	8, 080
Carp	286, 400	11, 543	245, 983	13, 884
Cat fish	102, 340	6, 151	229, 648	11, 688
Cod	2, 040, 137	69, 032	2, 582, 990	82, 374
Eels	396, 945	27, 517	799, 488	38, 309
Flounders	876, 683	28, 455	1, 333, 735	32, 659
Haddock	172, 883	5, 548	240, 050	7, 806
Hake	32, 621	684	98, 042	2, 359
King-fish	11, 854	978	44, 002	3, 935
Mackerel	84, 458	6, 208	16, 480	1, 322
Menhaden	163, 280, 345	405, 488	22, 193, 530	53, 726
Perch, white	60, 310	3, 245	631, 522	39, 381
Perch, yellow	3, 040	117	4, 810	239
Scup	645, 397	14, 102	622, 165	13, 572
Sea bass	311, 181	13, 990	2, 189, 533	79, 889
Shad	1, 828, 977	62, 745	12, 844, 432	293, 173
Sheepshead	3, 150	174	42, 735	7, 273
Snappers, red	76, 000	3, 040		
Spanish mackerel	13, 007	2, 061	83, 125	9, 726
Squeteague	2, 076, 930	53, 706	9, 401, 203	203, 419
Striped bass	81, 795	9, 765	274, 353	28, 695
Sturgeon	391, 055	34, 581	719, 024	21, 273
Suckers	17, 550	758	155, 511	7, 383
Tautog	51, 260	1, 607	314, 748	6, 029
Caviar	17, 256	11, 992	149, 302	79, 693
Crabs, hard	[1] 246, 633	1, 793	[2] 614, 785	15, 826
Crabs, soft	[3] 100, 823	3, 394	[4] 269, 078	25, 805
King crabs			[5] 1, 062, 190	4, 343
Lobsters	332, 378	30, 235	123, 876	11, 097
Clams, hard	[6] 1, 503, 192	205, 952	[7] 4, 495, 073	524, 339
Clams, soft	[8] 817, 800	60, 797	[9] 795, 000	66, 345
Oysters, market	[10] 12, 823, 237	1, 863, 607	[11] 9, 394, 147	1, 309, 411
Oysters, seed	[12] 1, 612, 275	121, 422	[13] 7, 970, 592	359, 913
Scallops	[14] 653, 178	53, 430	[15] 55, 800	3, 100
Turtles			12, 850	878
Shells	[16] 5, 460, 000	4, 550		
Other products	1, 309, 663	9, 497	2, 960, 835	14, 552
Total	210, 497, 376	3, 545, 189	90, 297, 118	3, 563, 766

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[1] 739,899 in number.
[2] 1,844.355 in number.
[3] 302,469 in number.
[4] 807,234 in number.
[5] 531,095 in number.
[6] 187,839 bushels.
[7] 561,884 bushels.
[8] 81,780 bushels.
[9] 79,500 bushels.
[10] 1,831,891 bushels.
[11] 1,342,021 bushels.
[12] 230.325 bushels
[13] 1,138,656 bushels.
[14] 108,863 bushels.
[15] 9,300 bushels.
[16] 91,000 bushels.

The number of persons employed in the fisheries of these States in 1898 was 9,185 for New York, and 12,270 for New Jersey; the capital invested amounted to $7,589,787 for New York and $2,337,422 for New Jersey; the value of the products was $3,545,189 and $3,563,766 respectively.

The large increase in the number of persons employed and in the capital invested in the fisheries of New York in 1898 as compared with 1897, is due mainly to the fact that the statistics for 1898 include the persons and capital in the wholesale fishery trade of New York City, and also to the transfer of the location of the menhaden industry, which has been consolidated to an important extent and is controlled chiefly in New York.

ARTIFICIAL DRIERS IN CURING CODFISH.

Several fish-driers have been in use in the British Provinces during the past few years. There are at present but four driers in use in the United States—namely, at Boston and Gloucester, Mass.; Rockland, Me., and San Francisco, Cal. The fish-drier seems to be destined to become a valuable adjunct to the outfit of the cod-curing establishment. It is not, as yet, intended to supplant open-air fish-drying, but will probably come into general use as an accessory. Any desired temperature and air current may be maintained continuously, and the kilns may be constructed to accommodate large quantities of fish. It permits of fish being dried quickly when it is necessary to do so, and is useful in drying export fish for climates where well-cured fish are desired. When fish, drying out of doors, are endangered by bad weather, they can be saved by being placed in the drier.

Two forms of drier are in use, one—Whitman's patent—in which the kiln is fitted throughout with steam pipes for maintaining the desired temperature, while an air current is forced through the compartments by a blower; the other—devised by Charles E. Weeks—in which the kiln is supplied with a current of warm air without the introduction of heating pipes into the kiln. The kilns in both driers consist of a number of connected booths, each holding about 12 sliding trays, upon which the fish are placed. The trays are about 10 feet long by 4½ wide, with bottoms of galvanized wire netting. The salted fish are laid on the trays either side up and appear to require no turning. Small fish dry in about 12 hours; slack-salted fish in 36 to 48 hours. The temperature is maintained at about 80° during the drying of heavy salted fish. The kiln of the Weeks drier at Rockland, Me., carries about 150 quintals at one time. The Whitman drier at Boston is much larger.

NOTES
ON THE
FOREIGN FISHERY TRADE AND LOCAL FISHERIES
OF
PORTO RICO.

By W. A. WILCOX,
AGENT OF THE UNITED STATES FISH COMMISSION.

FISH BOATS AND HOMES OF FISHERMEN AT MAYAGUEZ, PORTO RICO.

NOTES ON THE FOREIGN FISHERY TRADE AND LOCAL FISHERIES OF PORTO RICO.

By W. A. Wilcox,

Agent af the United States Fish Commission.

INTRODUCTION.

The writer was detailed to accompany an expedition on the United States Fish Commission steamer *Fish Hawk* to Porto Rico for the purpose of investigating the condition of the commercial fisheries. Inquiries were made respecting the quantity and value of fishery products imported, their source and character, together with the methods of handling them and the expenses connected therewith. The local fisheries of Porto Rico and its outlying islands were also investigated.

The steamer arrived at San Juan on January 2, 1899. The work was at once commenced at that port, after which the several places of importance in connection with the investigations around the island were visited. Of the large number of small streams, only a few could be visited, from lack of time. None of them have extensive fisheries, but many supply a local demand for fresh fish.

There are very few good harbors in Porto Rico, and in all except San Juan vessels landing or loading cargoes are obliged to use lighters, thus adding considerably to the expenses.

The statistics relating to the imports here presented were copied from the original records at the custom-houses. Those concerning the local fisheries were obtained through personal interviews with fishermen and other persons interested in the subject. The records of the custom-houses were found complete for a series of years and gave the statistics of imported fishery products. Unfortunately the records of local fisheries had at nearly every port been destroyed or taken away.

The metric system of weights and measures is used in Porto Rico. At the custom-houses weights are shown in kilograms. In this report they are also given in pounds.

The work of the expedition was advanced by assistance furnished by Brig. Gen. F. D. Grant, commanding the district of San Juan, Capt. James A. Buchanan, collector for Porto Rico, and other Government and Porto Rican officials, and De Ford & Co., bankers and fiscal agents of the United States at San Juan. Information was freely given by the leading importers, fishermen, and persons interested in the fisheries, to whom acknowledgments are hereby made.

USE OF FISHERY PRODUCTS IN PORTO RICO.

Porto Rico is reported to have between 800,000 and 1,000,000 inhabitants. That fishery products form an important portion of the food supply of the island is shown by the importation, in 1897, of about 34,156,000 pounds of dried, pickled, canned, and other fish valued at $2,123,931. The total imports for the year furnished for each inhabitant an average of from 30 to 40 pounds of fish. The value of imported fishery products, with the duty paid on the same during the five years named, was as follows:

Year.	Value.	Duty.
1893	$1, 325, 073. 52	$87, 677. 16
1894	1, 649, 601. 42	94, 834. 50
1895	1, 987, 676. 56	122, 087. 99
1896	1, 815, 010. 89	117, 497. 21
1897	2, 123, 931. 46	139, 661. 35

With the exception of occasional small shipments, principally of canned fish, to grocers, this large amount of imported fish is handled by a comparatively small number of commission merchants, whose principal business is in sugar and coffee. In some cases the merchants own and work plantations, and all of them make large advances on crops which they dispose of by direct sales or as forwarding agents, thus providing return cargoes to vessels arriving with fish. A number of firms have branch houses at the three leading ports of Ponce, San Juan, and Mayaguez, where they have long been established. The old leading firms have a high rating for integrity and financial standing.

The manner of receiving and handling fish is similar at all ports, with some variations due to port charges, different climatic conditions, etc.

Dry and pickled fish are received more or less regularly throughout the year, mostly from Halifax and Lunenburg, Nova Scotia. A few cargoes arrive from Yarmouth, Nova Scotia, and occasionally a cargo comes from St. Johns, Newfoundland. The total receipts of dry and pickled fish in 1897 amounted to 33,449,422 pounds, being from the following localities:

	Pounds.
North American British Possessions	28, 048, 735
United States	4, 909, 141
All other sections	491, 546

This amount approximated 85 per cent of dry fish and 15 per cent of pickled fish, the proportions of dry fish by species being 90 per cent cod, 7 per cent haddock, and 3 per cent hake. As received, the proportion of a cargo of 2,000 quintals would be about as follows: 425 tierces, 100 to 150 drums, 100 boxes, 100 half-boxes. Tierces contain 450 pounds net, drums 125 to 140 pounds, boxes 100 pounds, half-boxes 50 pounds.

The climate of Porto Rico, with its months of warm, damp weather and much rain, is very trying on dry fish. If not properly cured they will soon turn red or become soft and otherwise unmarketable. Fish from the United States would probably have to be cured harder than is customary for home or northern demand. They should be well but not too heavily salted, and well dried. Small-sized cod that will pack in tierces and drums without bending are preferred to large fish, except for the small amount packed in boxes, these being for the local city trade, in which large fish are desirable.

In past years consumers of dry and pickled fish in Porto Rico have apparently been more concerned as to prices than quality, much inferior fish being consequently sent to this island. Natives often buy fish, if of low price, that would not be used in the United States. Occasionally fish are condemned and destroyed by the city officials. The present indications point to a demand for a better quality of goods.

December, January, February, and March are the best months for keeping fish in good condition in Porto Rico. The largest demand is in January, February, March, and April.

Pickled fish are not much used. Split herring are preferred to round, on account of keeping better, and bring $1 a barrel more.

Alewives are not desired and are seldom received.

Mackerel are too high-priced to have an extensive sale, the few received being usually of small size, on account of being the cheapest.

Smoked herring receipts are light, and comprise both "scaled" and "lengthwise" fish.

The total value of canned fish imported in 1897 was only $151,408. High prices and duties may account for this small amount, which consisted chiefly of sardines from Spain, receipts from that country having been free of duty, except when shipped under a foreign flag, which was seldom. If canned fish could be furnished at a low price, their sale would no doubt largely increase as their good qualities became more fully understood.

Boneless fish are almost unknown. Their introduction would be slow at first, and only small initial shipments would be advised.

CUSTOM-HOUSES AND IMPORT DUTIES.

Under Spanish rule custom-houses were of first and second grades, the former permitting both imports and exports, the latter being limited to exports. Fishery products were considered in three classes, as follows:

Salt cod and stockfish; also fish fresh, salted, smoked, or marinated, including weight of salt and brine.

Fish and shellfish in oil, or preserved in any way in tins, including the weight of immediate receptacles.

Oysters of all kinds, and shellfish, fresh or dried.

Duties were assessed as to weights, regardless of values, being at so much per 100 kilograms of each of the three classes. Entries did not specify species, simply showing imports as consisting of so many packages of so many kilograms of the various classes.

Since the change in government a number of former custom-houses have been abolished. Those now open continue the old method of classification and assessment, with some changes in rates of duty, and all conduct an export and import business. The central office is at San Juan.

Offices now open are located as follows: San Juan, Mayaguez, Ponce, Humacao, Aguadilla, Arroyo, Arecibo, Guanica.

Custom-houses at the following places have recently been discontinued, and were all of the second class except the last: Fajardo, Naguabo, Cabo Rojo, Salinas, Guayanilla, Isabel Segunda (Vieques Island).

On January 20, 1899, the President, through the War Department, promulgated an order relating to the "Customs tariff and regulations for Porto Rico." This order, which went into effect February 1, made some changes in duties and regulations. Extracts are given as follows:

> Trade between ports of the United States and all ports or places in Porto Rico, and trade between ports or places in Porto Rico, shall be carried on in registered vessels of the United States and in no others.
>
> Any merchandise transported in violation of this regulation shall be subject to forfeiture.
>
> For every passenger transported and landed in violation of this regulation the transporting vessel shall be subject to a penalty of $200.
>
> This regulation shall not be construed to forbid the sailing of other than registered vessels of the United States with cargo and passengers between the United States and ports or places in Porto Rico, or between ports or places in Porto Rico, provided that none are landed, but are destined for some foreign port or place.
>
> This regulation shall not be construed to authorize any lower customs charges on the cargoes of American vessels entering from the United States than are paid on the cargoes of foreign vessels entering from foreign ports.
>
> Every vessel shall, on arrival, be placed under customs control until duly discharged.
>
> Within 24 hours after the arrival of any vessel the master must, under a penalty for failure of $1 per ton registry measurement, produce to the proper officer a manifest of her cargo, with the marks, numbers, and description of the packages and the names of the respective consignees, which manifest, if the vessel be from a port in the United States, shall be certified by the collector of the port of sailing.
>
> No vessel shall be allowed to clear for another port until all her cargo shall be landed or accounted for.
>
> All goods not duly entered for payment of duty within 10 days after their arrival in port shall be landed and stored, the expense thereof to be charged against the goods.
>
> Prior to the departure of any vessel from any of the ports herein designated the master shall deposit with the proper officer a manifest of the outward cargo of such vessel, specifying the marks and numbers of packages, a description of their contents, with names of shippers and consignees, with a statement of the value of each separate lot; also names of passengers and their destination. A clearance will then be granted to the vessel.
>
> Vessels engaged in trade between the United States and Porto Rico are exempt from tonnage dues.
>
> Duties from and after February 1, 1899, on fishery products are as follows per 100 kilograms:*

Salt cod and stockfish	$0.50
Herring, pickled, smoked, salted, or marinated	.50
Mackerel, pickled, smoked, salted, or marinated	1.00
Salmon, canned, smoked, salted, or marinated	5.00
Oysters of all kinds, and shellfish, dried or fresh	.50

---

*1 kilogram = 2.2 pounds avoirdupois.

A tare of 10 per cent is allowed from the gross weight of salt codfish in cases or barrels, and of 2 per cent when in sacks.

MONEY RECEIVABLE FOR CUSTOMS DUES.

All customs dues in the island of Porto Rico shall be paid in United States money, or in foreign gold coin, such as the Spanish alphonsinos (centen) and the French louis, which will be accepted in payment of such customs dues at the following rates:

Alphonsinos (25-peseta piece)	$4.82
Louis (20-franc piece)	3.86

It is further ordered that on and after February 1, 1899, and until further provided, the following Porto Rican or Spanish silver coins now in circulation in the island of Porto Rico shall be received for customs dues at the following fixed rates in United States money:

The peso (a Spanish dollar)	$0.60
The medio peso	.30
The peseta	.12
The real	.06
The medio real	.03

It is further ordered and directed that out of the Porto Rican coins so received a convenient supply shall be retained and carried for exchange for United States money at the rate hereinbefore enumerated, namely, 60 cents United States money for one Porto Rican silver peso.

IMPORTED FISHERY PRODUCTS CONSIDERED BY PORTS.

PONCE.

This city is located in the central part of the south coast. Its population is about 30,000, of which 3,000 to 4,000 are at the landing or playa, the city proper being 2 miles inland. The harbor is spacious, but much exposed; it has a good depth of water, except near the shore, necessitating the lighterage of cargoes. At the landing are located the custom-house and other offices of the government, and the principal commission and wholesale firms. In the matter of fish imports, Ponce is by far the most important place in Porto Rico. The receipts for 1897 are said to be a fair average of the imports of late years, and amounted in value to $1,016,447 on dry and pickled fish and $14,406 on canned fish. The bulk of fish imported has for many years been handled by three commission firms. The value of the dry and pickled fish received in 1897 from different countries was as follows:

British North American Possessions	$771,303.52
United States	234,972.50
All others	10,171.17
Total	1,016,447.19

Imported dry fish consists principally of codfish. Hake and haddock are said to stand the climate better than cod, but only a small amount can be disposed of. Poor codfish is preferred to hake and haddock of much better condition and lower price. Of pickled fish, a few herring are used, but seldom any alewives. Split herring bring $1 a barrel more than round. Smoked herring are only used to a limited extent, "lengthwise" being preferred.

Canned fish are but little used, the small amount imported in 1897 from different countries being valued as follows:

England	$8, 215
Spain	5, 808
United States	166
France	184
Italy	33
Total	14, 406

Imported fish are usually distributed to the interior in original packages, but when goods are to go over bad roads the packages are opened by the purchaser and the contents packed in bags, which are carried by pack animals.

The marketing of crops has some connection with the fish trade in the securing of return cargoes by vessels arriving with cargoes of fish. Coffee crops are moved from the last of October up to June; sugar crops from the last of January until the end of May. In 1899 the sugar crop began to move the first part of January, somewhat earlier than usual. Return cargoes can usually be had from the first of February up to the end of April.

Freight rates by sail from Ponce to points north of Cape Hatteras are subject to some variation. February 1, 1899, they were as follows: On molasses, $2 to $2.12½ a hogshead on a gauge of 110 gallons; sugar in bags, 16 to 17 cents per 100 pounds; sugar in hogsheads, 18 to 20 cents per 100 pounds net weight.

The various expenses connected with handling a cargo of fish are here given in detail:

Shed charges, $1.75 per 1,000 kilograms. Dredging dues, 50 cents per 1,000 kilos.

Lighterage, 25 cents a tierce; small packages in proportion.

Receiving, weighing, cooperage, and watching, 20 cents a tierce; small packages in proportion.

Cartage, storage, and delivery, 20 cents a tierce.

Discount on six months' time, 7½ per cent. Commission and guaranty, 5 per cent.

Custom dues (elsewhere noted).

In past years sales have, as a rule, been on six months' time, account sales with 7½ per cent discount being promptly made as soon as cargoes were disposed of. The state of the market was cabled to shippers, and, if not satisfactory to them, cargoes were stored and held for better prices unless their condition called for immediate sale. Sales are made on a basis of Spanish money, and so long as this continues no bankers' commission is charged on remittances.

Boneless fish here, as elsewhere, remain to be introduced. Small shipments are advised until this product becomes known and a demand is created. Small shipments of canned fish by United States packers are also advised. Dealers believe that canned fish of good quality, if prices were not too high, would meet with a favorable reception and supplant the European importations. In canned salmon, the pale or light-colored lower grades of good quality would not be discriminated against on account of color.

Large shipments of any fish products that the trade is not familiar with would not at present be recommended, but articles of good quality, packed to stand the climate, will find a market when they become known.

State of trade February 1, 1899.—As might be expected, under a change of government and unsettled financial conditions, the amount of business during the past few months has been light as compared with the same seasons of past years. The values mentioned are on a basis of Porto Rican or Spanish money, which often fluctuates. On February 1, 1899, $100 United States money was equal to 166 pesos, or Spanish silver dollars. Sales continue to be made on a basis of six months' time and discount of 7½ per cent. An improvement has been noticed, and encouragement is felt for the future. Each of the past three months shows increased imports. The following account of the receipts of fish has been furnished by Messrs. Fritz Lundt & Co., of Ponce:

> *November, 1898:* The only arrival since the beginning of this month was the steamer *Arkadia*, which brought to this market 399 tierces of codfish, 16 drums of codfish, 45 tierces of haddock, 4 tierces of pollock.
>
> The demand has been very strong and prices in all markets of the island have improved. Codfish of good quality $9.50 and haddock $8 per 100 pounds.
>
> *December arrivals with fish:* The schooners *Morales*, *Gladys B. Smith*, *Bravo*, and *Arctic*, from Lunenburg, Nova Scotia; schooner *Glad Tidings*, from St. Johns, Newfoundland; steamer *Winifred*, from New York.
>
> The total receipts for the month were 2,369 tierces of codfish, 230 drums of codfish, 218 cases of codfish, 622 half-cases of codfish, 154 tierces of haddock, 276 barrels of herring. With unsold stocks of previous arrivals, the prices declined as follows: Superior codfish, $7.25 to $7.50 per 100 pounds.
>
> *January, 1899:* Arrivals during the month were schooners *Fauna* and *Narka*, brig *Scepter*, and brigantine *W. E. Stowe*, from Lunenburg, Nova Scotia.
>
> These four vessels brought 1,764 tierces of codfish, 305 drums of codfish, 277 cases of codfish, 546 half-cases of codfish, 166 tierces of haddock, 50 drums of haddock, 308 barrels of herring, 300 boxes of smoked herring.
>
> *February 1* the stocks on hand were small and the market firm at the following quotations: Codfish, $8.50 per 100 pounds; hake, $5 to $6 per 100 pounds; haddock, $7 to $7.50 per 100 pounds; pollock, $5 to $6 per 100 pounds; herring, smoked, 25 cents per box; sardines, 70 to 90 cents per dozen ¼-pound cans, in oil or mustard.

These notes on arrivals, receipts, and state of the market for four months show that a healthy condition and favorable prospects for the future have quickly followed a suspended business and state of war with change of government.

SAN JUAN.

San Juan, the capital city of the island, is at present of considerable commercial importance. It is on the north side of the island, where there is much rough weather at certain seasons. It has a fine harbor, at the entrance to which is a light-house, 170 feet above the sea. The channel into the harbor is narrow and must be approached cautiously. During severe northerly winds sailing vessels are at times delayed in entering or leaving the port.

The city is credited with over 30,000 inhabitants. Its imports of fishery products are large, being exceeded by only one port.

The receipts of dry and pickled fish in 1897 were as follows:

From—	Kilograms.	Pounds.	Value.
British North America	3,380,410	7,452,524	$439,453
United States	268,729	592,446	34,935
Other sources	147,901	326,065	19,227
Total	3,797,040	8,371,035	493,615

The style of packages and proportion of each species are similar to those of other ports.

Canned fish amounted in value to $112,091, of which only $806 worth came from the United States. This formed the bulk of canned-fish imports of the island in 1897, which amounted to $151,409 in value.

Boneless fish are occasionally received in small amounts by retail grocers. Small introductory shipments only are suggested by the receivers.

The climate and season are important considerations in the shipping of dry fish. In general, the wet months are May, June, July, October, and November; the dry months, December, January, February, March, April, August, and September. There are more rainfalls and the weather is more changeable on the north side of the island. At San Juan, during December and the first part of January, 1898–99, which are reckoned as dry months, the rainfall was exceptional, coming in frequent and short, heavy showers during the day and night.

The sugar crop is marketed from January to August or September. During this time return cargoes can generally be secured, and to a considerable extent through the remaining months of the year. The coffee crop has chiefly been sent to Europe and Cuba between November and March.

Fish arriving by sail are reported as usually being in better condition than when shipped by steamer. Quick-sailing vessels of from 125 to 150 tons are best adapted for this business, and vessels of this character can discharge at the landing.

Consignments are opened and sampled when received, and values that can be ascertained at San Juan or other ports are cabled to the shippers. On receipt of replies, goods are sold or stored, as advised. The markets are fluctuating and subject to considerable variation, according to stocks on hand or known to be en route.

All important receipts of fishery products have been handled by a few commission houses, in connection with sugar, coffee, and other goods.

Often from two-thirds to three-fourths of the invoice value is advanced on shipments, for which one-half per cent bankers' commission is charged. Other charges are:

Wharf allowance, 4 per cent on gross value of invoice; weighing charges, 12½ cents a tierce; cartage, 6¼ cents a tierce.

Discount on 6 months' time, 6 per cent; commission, including a guaranty, 5 per cent. Customs duties as elsewhere noted.

Freight rates from San Juan to ports north of Hatteras have during the past years averaged as follows: On molasses, $2.25 per hogshead, gross gauge; sugar in bags of 250 pounds, 15 cents per 100 pounds.

Vessel property is not in demand at this or other ports. In the past the few sailing vessels of the island were of small size and were only used in the freight and passenger business near home. Recently small-sized steamers have largely taken this business, and at present there are more sailing vessels than are needed.

MAYAGUEZ.

This city, with some 15,000 inhabitants, ranks third in population and also in its fishery imports and its general business. It is near the center of the western end of the island, and resembles Ponce in being located a short distance inland, having its custom-house and its large fish, coffee, sugar, and other interests at the landing. The city is well laid out and handsome and has the only street-car line on the island, between the city and landing. The harbor is much exposed, with good depth of water except near the shore, necessitating the lighterage of cargoes.

The climatic conditions vary somewhat from those of the north side of the island. The usual wet months are May, June, July, August, September, October, and November. During December northerly winds prevail, accompanied by frequent showers. Months that are reported free from any rain are January, February, March, and April. August and September, mentioned among the wet months, are sometimes free from rain a part of the time.

Shipments of dry fish by sailing vessel can be best made during the winter months, while in summer shipments can be made more quickly by steamer. The best months for meeting with a good demand are January, February, March, and April. Shipments by the New York and Porto Rico Steamship Line can be made three times a month. These steamers do a freight and passenger business, making regular calls at Mayaguez, San Juan, and Ponce, and if there is sufficient inducement landings are made at Arecibo, Aguadilla, and Arroyo.

For a long time Mayaguez has been a receiving and distributing port for a large amount of imported fishery products. The receipts of dry and pickled fish in 1897 were as follows:

From—	Kilograms.	Pounds.	Value.
British North American Possessions	2,235,907	4,929,328	$290,587.91
United States	122,903	270,955	15,458.39
Spain	2,206	4,863	286.78
Total	2,361,016	5,205,146	306,333.08

The imports of canned fish were comparatively unimportant, being valued at only $19,732, of which $19,517 worth came from Spain.

Fish imports have been handled in the usual way by a few commission firms that are also largely interested in sugar and coffee. The following firms have been in business here for several years: Fritz Lundt & Co., Morales Gonzales & Co., Sabater & Co., Bravo & Co., J. Tornabells & Co., and Playa Brothers.

Imported fish are distributed by sales through the interior with occasional transfers of cargoes to other ports in which supplies are needed.

In the past long-time credits have been given, the receivers discounting the amount of the sales at the rate of 1 per cent a month and remitting as soon as sales were closed. With a change in government and a somewhat disturbed state of trade, the present tendency is to make sales as much as possible for cash. This has to some extent reduced sales during the past few months. Merchants complain that the former long-credit system was unsatisfactory, the selling party having largely to trust to the honor of his debtor for payment. If the latter was disposed to evade obligations, a recourse to law was so unsatisfactory that by some firms a total loss would be thought preferable to a resort to legal measures.

In case cargo shipments by sail are made, return cargoes of sugar and molasses can generally be secured from February to and including August. At the time this port was visited, during the latter part of January, 1899, no cargo lots of fish had been received for some time, and freight rates by steamer only could be given. These were: For sugar in hogsheads 22 cents per 100 pounds, and 18 cents per 100 pounds when in bags. These rates are somewhat higher than in the previous year. No shipments of molasses had been made up to February 22. Freight on sugar is made on the net delivery weight.

In past years the coffee crop has all been sent to Europe and Cuba. Since the change in government no coffee has been sent to Cuba, and a considerable amount is being sent to the United States as introductory shipments with expectation of an increased business with the States, both in coffee and fishery products.

The expenses on a cargo of fish would embrace the following charges:

Port dues, $1.50 per 1,000 kilograms.

Lighterage, receiving and weighing dues, 40 cents per tierce, and smaller packages in proportion.

Commission, including guarantee, 5 per cent; time sales when discounted, 1 per cent a month; customs dues, as elsewhere noted.

The receipts of 1897 were a fair average of those of past years, and consisted of 90 per cent cod, 5 per cent hake and haddock, and 5 per cent pickled and smoked fish. Here, as elsewhere, much loss has resulted from fish turning red and spoiling.

Boneless fish are unknown, but dealers express a desire for experimental lots, well cured, and hope to create a demand for boneless and canned fish, but do not encourage large shipments at first.

Canned fish consist chiefly of sardines from Spain.

Wholesale values of dry cod for the past three years per 100 pounds are here shown by months, as ascertained from the books of dealers at Mayaguez:

Month.	1896.	1897.	1898.
January	$5.50	$5.50	$6.00
February	....	6.00	7.00
March	5.00	5.50	7.00
April	4.50	6.00	7.50
May	5.50	7.00	9.25
June	6.25	8.00	10.50
July	5.50	7.00	8.25
August	4.50	5.00	....
September	8.75	5.50	....
October	9.00	6.25	10.50
November	7.00	6.00	10.00
December	6.00	6.50	8.25
Average	6.12½	6.20	8.50

During January, 1899, the market was as follows:

Codfish, $8 per 100 pounds; hake, $5 to $6 per 100 pounds.

Haddock, $7 per 100 pounds; pollock, $5 to $6 per 100 pounds.

Pickled herring, $4 to $6 per barrel for round and split; the latter $1 a barrel more than round.

Sardines in oil or mustard, in ½-pound boxes, 70 to 90 cents a dozen.

All quotations given are on a basis of Spanish money, which, on account of fluctuations, has resulted in an unsteady market to both receivers and shippers.

ARECIBO.

Of the ports on the north side of Porto Rico this place is second only to San Juan, with which it is connected on the west by 58 miles of railroad. It has a population of 6,000 to 8,000. The harbor is much exposed, with dangerous reefs close to the shore. Cargoes have to be lightered to and from vessels.

In the imports of dry and pickled fish this city ranks fourth in the amount of value, which in 1897 were as follows:

From—	Kilograms.	Pounds.	Value.
British North American Possessions	1,173,279	2,586,636	$152,426.27
United States	7,673	16,916	997.49
Total	1,180,952	2,603,552	153,423.76

Canned fish imports were all from Spain, amounting to $2,333.

Of the dry fish handled, some 25 per cent additional to the above was received from the San Juan and Ponce importers. The original importers of the several ports draw on or supply each other according to the condition of the trade. The imports for 1897 are said to have been on an average with those of past years.

The principal fishery imports consisted of small-sized dry cod from Nova Scotia. Receipts in recent years have been handled principally by the following firms: G. Ledesma & Co., Rosas & Co., Ledesma, Artau & Co.

AGUADILLA.

This port, with a population of some 5,000 to 6,000, is located at the northwestern end of the island. The harbor is poor, being simply an indentation in the shore line. A good depth of water is found to within a short distance of the beach, on which quite a surf breaks. The place is of considerable importance as a distributing point for this section. The mercantile business is represented by numerous stores, a few of which carry quite large stocks, of which dry and pickled fish form an important portion.

The annual distribution of fish from this port is stated to be 2,500 tierces of dry cod, 500 barrels of pickled herring, and a small amount of smoked and canned fish. The fish go principally to the interior of the island. Very little is imported direct, the supplies in general being bought as needed from importers at Ponce, San Juan, and Mayaguez. Occasionally small orders are sent to the United States.

The direct imports of fish in 1897 amounted to 19,965 kilograms, or 44,015 pounds; $2,595 worth of dry fish came from New York and $2,845 worth of canned fish from Spain. Nearly all dry fish handled are quite small, these being preferred to those of medium size.

The following seven firms handle the bulk of the fish received: J. T. Silva & Co., Yumet & Co., Angel Ma Yumet, Ernesto Rubio, R. Ponce & Co., Jose Diaz, and Schnabel & Co.

Boneless fish are unknown, and canned fish of American pack are seldom used. Dealers express a desire to increase their business with the United States, in the hope of receiving a better class of goods, adapted to their trying climate, the losses from fish turning red and spoiling being considerable.

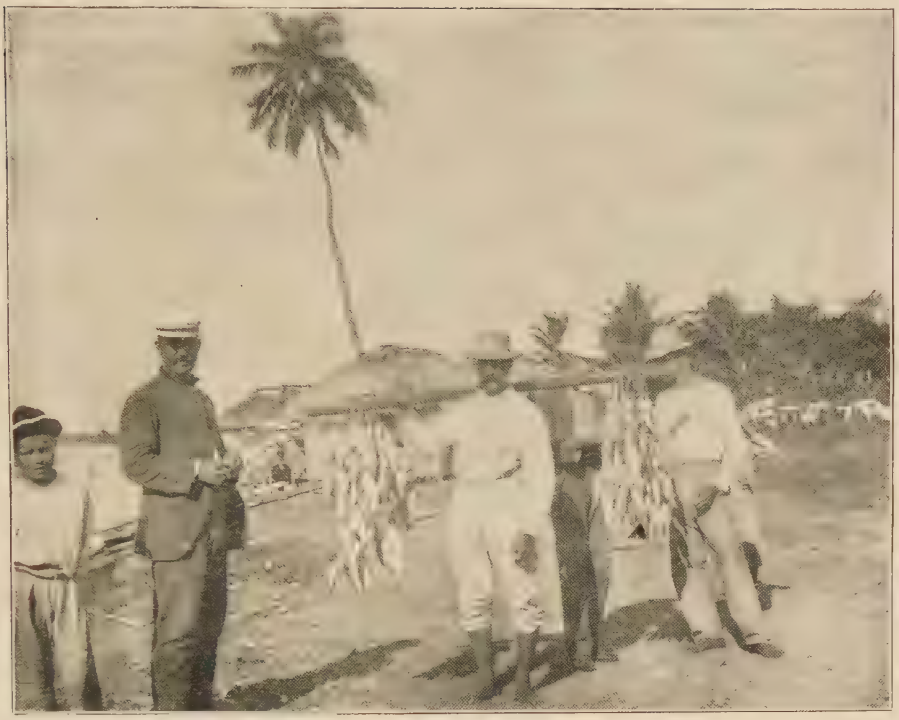
ARROYO.

This port of entry is near the southeastern end of the island. The population is stated at 1,200. Dry and pickled fish are largely used and distributed through the interior, it being claimed that the monthly receipts average 120 tierces of dry fish. Most of the fish products come from the importers at Ponce, the direct imports being small.

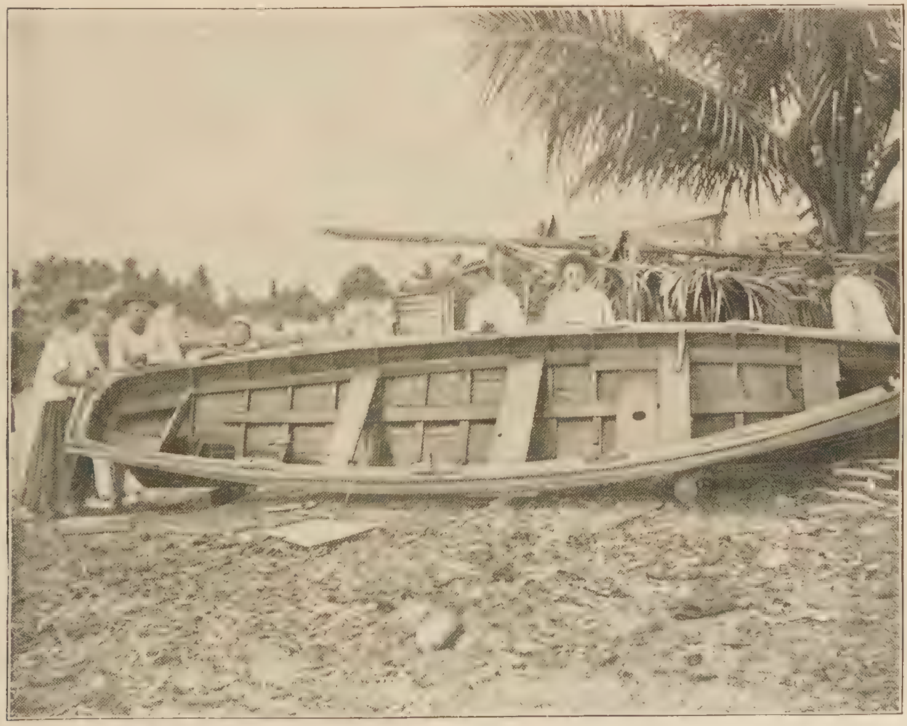
The custom-house records show the direct imports during the past six years as follows:

Year.	Kilograms.	Pounds.	Value.
1893	None.	None.	....
1894	1,482	3,267	$148
1895	32,331	71,278	5,203
1896	6,350	13,999	825
1897	None.	None.	....
1898	60,116	132,533	7,815

The imports in 1894 were all from the United States, those for the other years were from Nova Scotia. The only direct import in 1898 comprised 200 tierces and 3 boxes of codfish and 100 barrels of herring, from Lunenburg, Nova Scotia.



FISH PEDDLERS AT PORTO REAL.



FISHING BOAT AT MAYAGUEZ

FRESH-FISH BUSINESS.

Fishing for a livelihood is not carried on to a large extent anywhere in Porto Rico, and scarcely at all for sport. A few fishermen at the several ports make a living by fishing, plantation work, and labor at the docks on vessel cargoes.

The professional and semiprofessional fishermen, as noted by the writer, number nearly 800, and employ about 350 sail and row boats.

The local fisheries yield numerous species of fine edible fishes.

In view of the large amount of dry and pickled fish imported, it is at first surprising that so little attention is given to this business. As a rule, the local demand is indifferently supplied with fresh fish, usually at high prices. Ice is never used, and only the few fish taken of large size are dressed. None are canned, and the only attention given to curing is when an extra large catch is made, a few being then poorly cured for the home use of the fishermen.

In past years the best of the business was monopolized by the few persons interested who had means to buy the exclusive right to fish at the most favorable localities, such as near the outlets of streams and at other desirable places along the coast. Rights were advertised and sold at auction by the authorities. At some ports the local authorities imposed a special tax on all fresh fish landed.

Under Spanish rule all fisheries were in charge of an officer known as the captain of the port. Any person wishing to engage in the business was obliged to procure from him a license and be enrolled in the reserve naval force, licenses being granted only to subjects of Spain. Boats were numbered, and a record kept of licenses, men, apparatus, and, to some extent, of the products. Unfortunately for our knowledge of the former extent of the local fishing industry, the records of the captains of the ports were either destroyed or carried away by those officials at nearly every port when the change in government took place.

With the change of government, the granting of exclusive fishing privileges in the waters of Porto Rico and its adjacent islands was abolished by an official order, a copy of which is here given:

HEADQUARTERS DEPARTMENT OF PORTO RICO,
San Juan, P. R., December 4, 1898.

From and after this date the granting of exclusive fishing privileges in the streams, rivers, bays, inlets, and other waters of Porto Rico and its adjacent islands will be discontinued and the right of fishing in the said waters will be absolutely free; but all persons who enjoy said free privileges will be subject to the common and statute laws which govern fishing in said waters.

By command of Major-General Brooke:

M. V. SHERIDAN,
Brigadier-General, U. S. Volunteers, Chief of Staff.

At the time of taking these notes, February, 1899, a new cabinet had just been seated; its officers reported that no action had been taken on the fisheries; all fishing and the landing of their catch by fishermen were free from tax; no reports had been received from the several districts, and their officers had no records relating to the fisheries or statistics as to their past condition.

The apparatus consists of a limited number of nets, trawls, and trolling lines, and many wicker-made pots or traps. It is of the most primitive character and is made by the fishermen.

Fishing for sport may possibly receive more attention in the future than in the past, as a large number of mountain streams and lakes are more or less supplied with fresh-water fish, while numerous species are available in salt water.

SAN JUAN.

The fisheries at this city receive little attention. Seventy-five men claim to be fishermen, using 4 keel and 25 flat-bottomed boats of small size and little value, lateen sails being used. These men work on the neighboring plantations more or less, only a few of them being engaged in fishing at any one time. Part of the catch is made by haul seines, in which small fish are taken. Trolling lines are largely used in deep water, far from shore, for fish of large size.

The catch is principally made late in the day or during the night, so that the market can be reached by 4 a. m.; a fair average of a day's catch by three men and one boat being 250 pounds. On landing the catch at the city it is usually bought by a middleman at from 4 to 8 cents a pound, but not paid for until disposed of either at the city market or by peddlers. Fish are peddled strung from poles, and are also carried in large, oblong, shallow baskets.

The retail prices range from 15 cents a pound upward. The largest fish are often cut up in slices to supply small demands; small and medium fish are never dressed, and no ice is used in the business. This manner of disposing of fish by peddlers is in general practice at the several ports.

Many of the species are brightly colored and curiously marked, and make a very attractive appearance when first caught. Many of them have fine edible qualities.

PONCE.

In view of the large imports of dry and pickled fish and its general use by the 30,000 inhabitants of this city, and the number of so-called fishermen of the place, the amount of its fresh-fish business is surprisingly small.

The captain of the port reports that since the late change in government 127 men have been enrolled and granted permission to fish, free of any charge, in the waters of the district. They use 60 small open boats of an average value of $40. The boats are of schooner, sloop, and cat rig, together with skiffs and dories with sails. None of them are large enough to be entered at the custom-house or to need any papers except that granting the privilege of fishing. The fishermen follow the fishing business very irregularly, and of the 60 boats enrolled the average number engaged in fishing from day to day is not over 5 to 10.

The catch is made chiefly with set pots anchored in and about the harbor; single hooks and lines are used, and a few haul seines are operated along the water front.

No fish are dried, smoked, pickled, or canned, all being disposed of fresh for local use. The aggregate catch is small, and no record is kept of the amount.

There is said to be a scarcity of fish in this vicinity. So long as the fishing is done with set pots, in which bait is seldom used, only light catches of small and medium fish can be expected. A few large fish are taken by men with a single hook and line in deep water.

The city of Ponce has quite a large and good general market, in which the fresh-fish business makes a poor showing, with its one stand, on which a few fish are sold by two or three men. Fish are sold here, as elsewhere, through the streets by peddlers, who carry them suspended from poles borne on their shoulders. Those of small size are tied in bunches and sold at so much a bunch; if large enough to weigh 2 to 6 or 8 pounds, at so much each. None are sold by weight. None are dressed, and ice is not used.

Retail prices average 10 to 15 cents a pound in Spanish money, which was worth 60 cents on a dollar when exchanged for United States money.

The old records now in the custom-house at Ponce show that during the portion of 1898 in which it was under Spanish rule the fishing business of the district was represented by 340 fishermen, with 109 registered boats. This district then included most of the south side and a small portion of the west end of the island, or about one-third of the coast line of Porto Rico.

That the business was carried on with little energy or return to the fishermen may also be judged by the value of the catch, as shown by the old records, for the last six months of Spanish rule. The aggregate value of fish taken in the district of Ponce by the 340 enrolled fishermen for that portion of 1898 when it was held by Spain amounted to 26,815 pesetas; this represents only $3,218 in United States money. On account of the disturbed condition of all Porto Rican business in 1898 that year can not be considered as a fair average.

MAYAGUEZ.

The fresh-fish business of this port is not extensive, but the market has a larger supply and better variety of fish than are found at the markets of San Juan and Ponce. The catch is made by 25 fishermen, who use 10 to 12 small sloop-rigged keel boats. Most of the boats have a well in the center to keep the fish alive until disposed of. An equal number of dories are used. The former are built at the port at a cost of from $50 to $175 each. The dories are of Canadian or United States make, having been purchased of vessels arriving with dry fish.

The custom-house at this port reports one vessel, of 7½ tons, in the fisheries of the district.

Under Spanish rule fishing and fish landed were free of tax or duty at this port, but fishermen and boats were recorded by the captain of the port. This officer fled on the approach of the United States forces and left no records of the previous business. At present fishing is free, but no record of persons or boats employed or any account of the catch has been made up to the time these notes were taken.

The fishing-grounds for haul seines and cast nets are along the beach near the city landing; in the harbor and open sea, to a distance of 8 to 10 miles, hooks and lines and set pots are employed. Two haul seines, each 450 feet long and 12 to 15 feet deep, are hauled by 6 to 8 men. The nets are hand-made, and have a nominal value of 150 pesos, or Spanish dollars, each. Many species of fish are taken in the haul seines.

Wicker pots or traps are anchored in from 18 to 25 fathoms of water. Six boats, with from 12 to 25 pots each, are used near the landing and as far out as 10 miles.

Spiny lobsters are reported as found at all seasons, but mostly during April and May. They weigh from 2 to 10 pounds each.

Cast nets, of which the local name is *tarraya*, are fished along the beach for sardines and other small fish; their value is from 5 to 8 pesos each, and there are 14 in use.

Three trawls are fished by six men in three boats, in from 8 to 100 fathoms of water, some 8 to 10 miles west from the city landing of Mayaguez. From 75 to 200 hooks are used to each trawl, and these are fastened to snoods 3 feet long and 1 fathom apart, with 1 hook on each. Trawls are baited with sardines and anchored. They are often underrun, and are taken up as soon as a sufficient catch has been made or the time has arrived for a return to market. The trawls are valued at from $3 to $5 each.

Trolling lines are used to some extent, with single hook baited with sardines. The hooks used are Nos. 1 to 9; the largest, No. 1, retail for 5 cents each; while No. 9 hooks, used on trawls, are worth 50 cents per 100. Twine for trawls is worth 25 cents per pound.

The catch is sold by peddlers, who buy the fish or are hired by the fishermen, and to fish-stands in the large market of the city. The fishermen receive, on an average, the equivalent of 6 cents a pound, the consumer paying about 10. All fish are sold undressed, at so much a bunch for those of small size; large fish are cut into strips and sold by the piece.

Fish are most plentiful in the harbor of Mayaguez from August to December, but are abundant outside of the harbor at all seasons. None of the catch is in any way cured.

ALGARROBO.

Algarrobo is a small fishing settlement in the suburbs of Mayaguez. The fishermen's houses scattered along the beach are surrounded with cocoanut trees and banana plants, the leaves of which form the roofs and sides. This settlement has 14 fishermen, who use 4 dories and 1 sloop. This sloop, the *Francisca*, was built at Algarrobo at a cost of

$1,200, Spanish money. It measures 7½ tons and is the only vessel used in the fisheries of the island that is of sufficient tonnage to require registry at the custom-house. It was built soon after the close of the late war and had made but three short trips up to the last of January, 1899. It is 30 feet long, 9½ feet beam, with 5 feet depth of hold. In the center is a well 7 feet long, with 31 1¼-inch holes on each side, to admit the water. Aft of the well is a small compartment for sleeping quarters, and forward is a small galley for cooking. Her fishing gear consists of 40 set pots, by which most of the catch is made, a small trawl with 100 hooks being used occasionally.

The catch of the fishermen of this place is made along the coast, the sloop going as far as off Mono Island, 42 miles distant. One haul seine is used along the beach by 5 men; this is 80 fathoms long, 3 fathoms deep, mesh in the wings 1 and 2 inches, and in the bunt ¾-inch square mesh. Ten pots and a trawl with 80 hooks are used just off the beach in 6 fathoms of water. Sardines are used for bait on the trawl, the pots generally being set without bait.

SABANITA.

This settlement is a few miles north of Algarrobo. From 30 to 40 men carry on more or less fishing, in which they use 2 haul seines, 50 to 75 pots, and 6 trawls. The apparatus is similar to that at Algarrobo. Two boats are used in seining, 5 in fishing pots, and 6 in trawl fishing. The two last-mentioned appliances employ 2 men in a boat.

Other small fishing-places in the vicinity of Mayaguez are Añasco, Arribo, and Corega, each with a few men who fish in the vicinity of their homes. The catch is sold to the neighboring villages and plantations, and the fish market of Mayaguez is better supplied than that of any other place on the island. Fish are peddled along the route to the city, being suspended from poles carried on the shoulders.

No fish are cured and any surplus is thrown away.

BAYAMON.

This place is 5 miles southwest of San Juan, with which it is connected by rail. The population is given as 2,500. It has a number of stores that carry quite large stocks of goods, including dry fish, bought from the importers at San Juan. The Bayamon River flows through the town, with its outlet at the entrance to San Juan Harbor. This stream, although small, is of some value for its fisheries, the most extensive being at Palo Seco at its mouth. At Bayamon the river is only 25 feet wide, with from 3 to 10 feet depth of water, according to the seasons. Near the mouth it widens out to some 75 feet.

Bayamon is supplied with fresh fish taken from the river by 6 resident fishermen, and by others that live along the river banks to the north and south. Other persons fish only for their family use. None of these men give more than a part of their time to fishing. The catch is taken with hoop nets, cast nets, gill nets, and haul seines, all netting being hand-made by the fishermen. A few fish pots are also used.

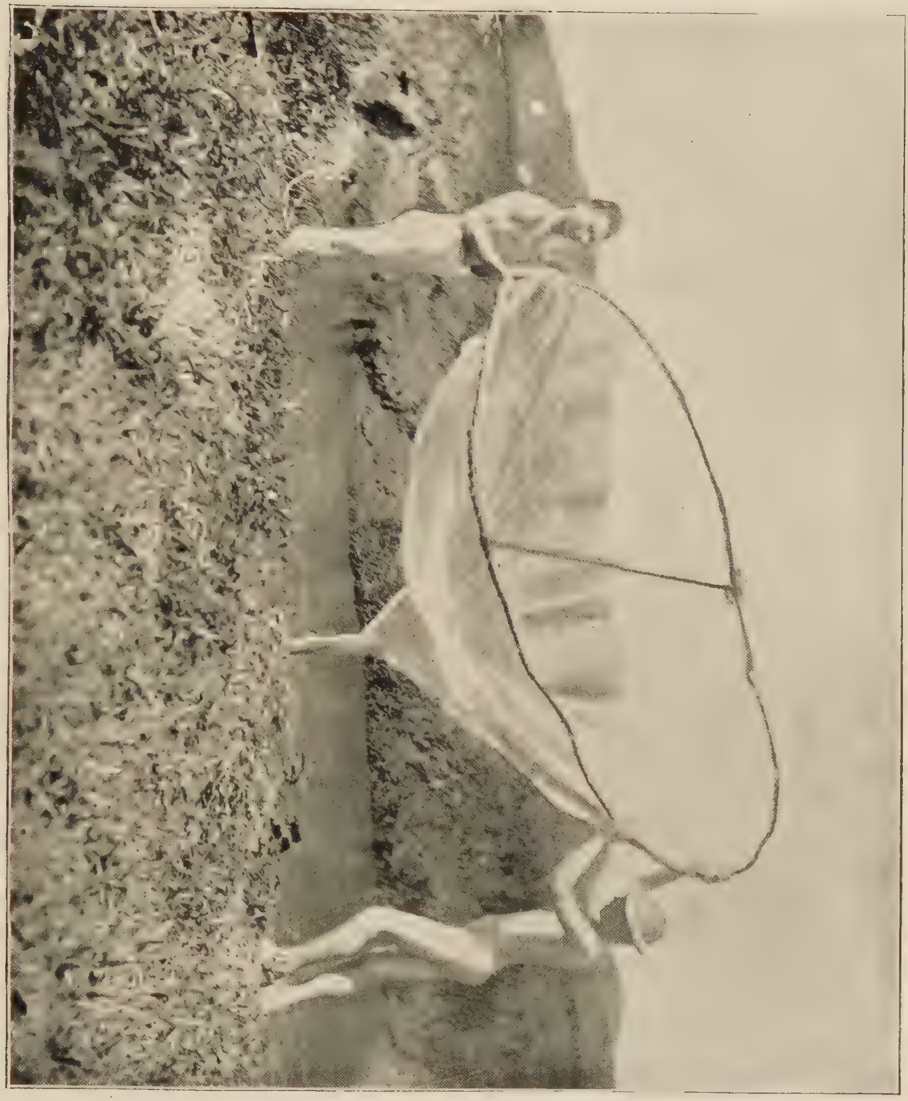
Hoop nets are of funnel shape, the large end being oblong, 6 by 4 feet, and 6 feet in depth, of 1-inch-stretch mesh. The netting is fastened at the large end to a piece of *poma rosa* wood, such as is used for hoops on hogsheads. These nets are used at holes or indentations in the banks, against which they are placed; the ground in the vicinity is pounded or punched with feet and pole and the fish frightened into the net.

Cast nets, with the local name of *nasa de arco*, are also used in this and other small streams and along the sea beaches. They are funnel-shaped, the large end being 6 to 10 feet wide, tapering off through its 6 to 8 feet of depth to a point to which a line is attached; the netting is 1-inch-stretch mesh, with the bottom leaded. In its use the net is gathered up on the arm of the fisherman, the narrow or pointed end being held in one hand, while the net is partially opened by holding the lead line between the teeth and grasping it with the other hand at a point conveniently distant from that where it is so held, as with a dexterous whirl he casts the net from him over the water. If properly thrown it spreads wide open before striking the water, and in this position sinks to the bottom, after which it is immediately drawn in and the catch removed. Cast nets have a value of $5, and yield a variety of small fishes and shrimp.

Palo Seco is a small fishing village at the mouth of the Bayamon River. It has a population of about 200, including 60 fishermen, who use 25 small sail and row boats with fishing appliances similar to those before noted. The catch by these men is chiefly made in the evening and at night and forms a portion of the fresh-fish supply of the city of San Juan. It is taken in and near the mouth of the river and in the bay, a few boats using trolling lines outside of the harbor. Fish pots are set in the river and bay and outside of the harbor. When used in the river they are attached to the shore by a line; when used outside they are weighted with stones and anchored to a buoy, although when well water-soaked they need no weights.

This is one of the few localities in which pots are baited; the fishermen report using in them burned bones, hoofs of cattle, and sour or decayed oranges. These pots are similar to the New England lobster pot, and differ in general construction from those in common use elsewhere around the island. They are 4 to 10 feet long by 1½ to 5 feet in diameter, with funnel entrance at one end only and a trapdoor on the top by which the catch is removed. They are made of bamboo splints. Pots are left anchored over night and the catch is removed in the morning.

Haul seines are used near the mouth of the Bayamon River and along the neighboring beach of San Juan harbor. They are of various lengths, those in general use being 300 feet long and 15 to 20 feet deep, with mesh of 2-inch bar, except in the bunt, which is of heavier twine and ¾-inch mesh. They have a nominal value of $50, of which $25 is allowed for cost of twine and an equal amount for leads, corks, and labor, the nets being made by the fishermen.



NATIVES WITH HOOP NET, BAYAMON RIVER.

Gill nets are about 600 feet in length by 12 feet in depth, with mesh of 2-inch bar. They are drifted with the tide in the bay. Often the water near the nets is pounded with poles to drive fish into the meshes. Hemp twine from Spain is used. For haul seines No. 8 twine is used in the wings and No. 5 in the bunt. The fishermen pay 75 cents a pound for this twine, buying a few balls at a time.

The boats are very expensive as compared with the cost of similar ones in the United States. All are open, with no deck or cabin, and use lateen sails. The largest, with keel bottom, cost from $200 to $300 each; the smaller keel boats cost $100 to $150, and common skiffs $40 to $50 each. In fishing, 2 to 5 men go in each boat.

Trolling hooks are used outside of the harbor of San Juan as far as 10 or 12 miles, but fishing with them is not followed with any regularity. In troll fishing large fish are caught, the largest being the *arbujo*, which is taken in deep water at all seasons and is said to weigh as much as 50 or 100 pounds.

Fish weirs or traps are used in the Bayamon River by building a hedge of canes across the stream with a gateway for passing boats. The hedge is made with indentations or pockets at various places on each side. Fish in their movements up or down stream enter these pockets and are taken out with dip nets. In some streams hedges have no pockets, but instead, funnel-shaped cones of bamboo or cane splints are inserted at various places. Fish seeking a passage through the hedge enter these cones and become wedged, few escaping.

Fishing is carried on at all seasons, fish being most plentiful during July. Dynamite has sometimes been illegally used to kill fish in some streams and in the bay.

The fishermen at Palo Seco give more attention to fishing than at most places. Prices received by them, 4 to 6 cents a pound, have in the past left them but a small margin of profit after the payment of expenses and taxes; at the same time the consumer had to pay 15 cents and upward a pound for undressed fish.

ARECIBO.

From 40 to 50 men at this port follow fishing for a living at all seasons of the year when the weather permits.

The fishing-grounds are along the beach at the city front, and 3 to 4 miles out, and in the nearby waters of the Rio Grande. Several species of fine edible fish are found at all seasons of the year.

The boats used are of small size, with keel or flat bottom. They are built at Arecibo, and, as in other places, are expensive, a small, open keel boat bringing $100 to $150, and the common flat-bottom skiffs $30 to $50, in Spanish money. Twelve to 15 boats with lateen sails are in use.

A large portion of the catch is made by 2 haul seines, each 360 feet long by 12 feet deep, 12 to 14 men being required to haul one through the swells and surf of the beach. The seines are made by the fishermen.

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The bow rig, with from 3 to 6 hooks attached to each of the short snoods suspended from its end, is used from 3 to 4 miles from shore, in from 60 to 150 fathoms of water. They are employed on 6 or 8 of the largest boats, carrying from 3 to 4 men each.

About 40 cast nets are used along the beach and in the river, taking sardines and other small fish.

The Rio Grande, having its outlet at Arecibo, is one of the many small streams which has its source in the adjacent mountains. For the first 16 miles from its mouth it is more or less fished throughout the year by cast nets, and occasionally by haul seines near the mouth. Under Spanish rule no weirs or traps of any kind were permitted in the river, and haul seines only by special permission. No fish are cured, all being sold fresh by the fishermen, who carry them suspended on poles, selling small fish by the bunch and those of large size by the piece. A market is found in the city of Arecibo and the surrounding plantations. The prices received are 6 to 8 cents a pound, the fish being sold direct by the fishermen to the consumer.

AGUADILLA.

Fresh fish forms a large portion of the food of the 5,000 inhabitants of this city and vicinity. The catch is made in the waters of the bay, a small amount coming from the Culebrinas River, which is fished from its mouth for 2 miles upstream. The river catch consists chiefly of small fish taken with cast nets.

Fishing in the bay is largely by 10 haul seines used along the beach. Each is from 150 to 300 feet in length by 15 to 20 feet in depth, with mesh 3 and 1¼ inches in the wings, and ¾ inch in the bunt. They are hauled by 6 or 8 men to a net.

There are 10 trawl lines used in from 50 to 100 feet of water, having from 100 to 200 hooks, each attached to short snoods. For deep-water fishing, from 3 to 4 miles offshore, the bow rig is employed. This is simply a bow of strong wire, at each end of which is attached a short line having from 1 to 4 hooks. Fifty of these are used in water from 300 to 500 feet deep. The value of a bow rig of hooks and line is 4 pesos, or dollars. The principal part of the catch by the bow rig is the very handsome spotted redfish (*cabrilla*), of fine edible quality, weighing from 5 to 10 pounds each.

Sixty cast nets having ½-inch, square, mesh, and valued at $4 each, are in use. Forty traps or pots are used in the bay, and at times a small number are fished in the river. They are made of woven bamboo splints fastened to light frames, each 3 feet in diameter and somewhat smaller than those used at other places. They are valued at $4 each, and in bay fishing are anchored in 40 feet of water.

Fishing is chiefly in the early morning, with considerable toward the close of the day, and very little between morning and late afternoon.

The boats are all flat-bottomed dories, similar to those in general use in New England; they are 12 to 18 feet long, 3 feet beam, with sides of imported pine and frame of native wood. They are made at the port and valued at $25 each.

It is claimed that the waters in this vicinity have a better and more plentiful supply of fish than is found elsewhere about the island. Fish are reported as being always abundant off the northwest coast of Porto Rico. On account of lack of transportation facilities fishing receives little attention and the inhabitants of the interior depend largely on imported dry fish. A few miles of railroad connect Aguadilla with the city of Mayaguez, yet no fish are shipped away or cured. There being no fish market or dealers, the fisherman ties his catch into bunches or sliced-up pieces, suspends them on a pole, and peddles them among the adjacent plantations. The average price for fish is about 6 cents a pound.

Aguadilla is the only port in which the old Spanish system of keeping a record of the fisheries is yet in vogue. For many years records were kept by the former captain of the port. He still takes an interest in the business and continues to record the number of fishermen, their apparatus, and approximate catch. He reports at present 40 boats and 100 fishermen at this port and places their aggregate catch during the past year at 80,000 pounds. Although the time given embraces the period of the late war, the amount reported is so small that it probably does not represent the full catch.

PORTO REAL.

This is a small village of 250 inhabitants, located near the southwestern end of Porto Rico. It is the landing-place for Cabo Rojo, which formerly had a second-grade custom-house, permitting exports but no imports. A small amount of fishing is carried on here by 25 men.

The boats are 12 to 15 feet long, home-made, and are roughly but strongly built; 5 of them are keel boats with a small well in the center, and are valued at $40 each. Seven skiffs, worth $5 each, are used near shore. Boats are of sloop and schooner rig, and carry 2 men each.

The fishing apparatus consists of 2 haul-seines, used along the beach, 150 pots used from 1 to 2 miles from shore, and single hooks and lines used from 5 to 10 miles from the home port.

The catch is kept alive either in the well of the boat or in cars anchored off the landing, until disposed of in the vicinity or taken to Mayaguez. In this vicinity fish are reported plentiful and many are beautifully colored and have fine food qualities.

The lagoons or arms of the bay of Porto Real are bordered with mangrove trees that extend back through the adjacent swamps. For several miles on both sides of these lagoons oysters of small size are found in dense clusters attached to the roots and lower branches of nearly all the trees along the banks. These oysters are free from any coppery flavor, but are of poor quality and of small value at present; they are not found on the soft muddy bottoms of the lagoons. Commercially there is no native oyster business on the island, and but few imported canned oysters are sold. Occasionally a few of the former are gathered and sent in the shell to the largest cities.

At the bay of Boqueron, a few miles south of Porto Real, fishing is engaged in by 4 men with 2 small boats of sloop and schooner rig. Hooks and lines and pots are used in taking the limited catch, which is disposed of in the neighborhood.

ARROYO.

From 30 to 60 men engage more or less in fishing at this place, with haul seines, cast nets, and pots, the larger part of the catch being taken in pots, and chiefly from May to August; during the remainder of the year most of the fishermen work on plantations. They make their own boats, which are roughly built, but very strong, without decks or wells, and 15 feet long by 6 to 7 feet beam. Thirty-five boats are in use, with an average value of $50;-2 men go in each.

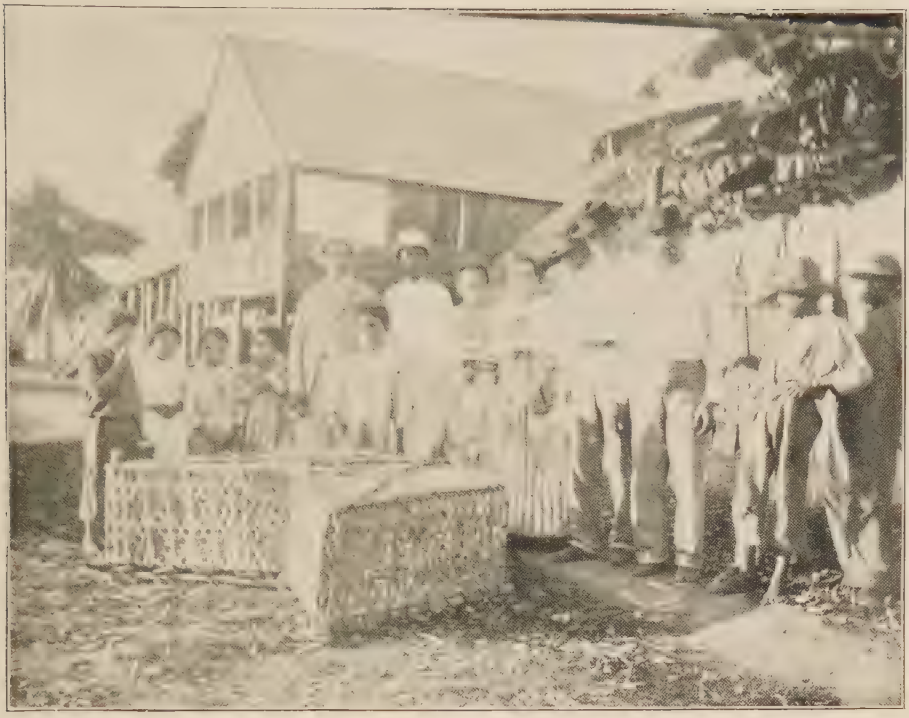
Turtles are found at all seasons, being most plentiful from September to the last of December, during which time they deposit their eggs in the sand of the beach. The catch is small, and made only when turtles are found on shore. The value of the fishery lies chiefly in the shell of the hawksbill, for which the fishermen receive $3 a pound, Spanish money. The largest shells weigh from 5 to 6 pounds; the meat is sold to the natives at 4 to 6 cents a pound.

In the latter part of November, 1898, this section was fished for turtles by the crews of two small cat-rigged vessels from the English island of Tortugas, who used large-mesh nets to which wooden decoy turtles were attached, the nets being set near the coral reefs off the harbor of Arroyo. The vessels remained two weeks and it was reported that a fair catch was made.

Between April and September trolling lines are used, chiefly for kingfish, which are said to weigh from 20 to 30 pounds on the average, some being much heavier. Among the other fish taken in trolling are the capitan and barracuda. Trolling is done between sunrise and 8 or 9 in the morning.

A few haul-seines are employed. The largest are 200 feet long, and 10 to 15 feet deep, with a bag net in the center; the mesh is 1½ inches (square) in the wings and 1 inch in the bag. There are 6 small seines, each 120 feet long, with ½ inch (square) mesh, and are without any bag attachment. Small seines are chiefly for taking bait for hook-and-line fishing. Six cast nets are employed along the shore. Six trawls are operated, having from 50 to 200 hooks each, with snoods 2 feet long and placed 4 feet apart. The buoy to the trawl is said to have a bell attached by which the fishermen judge as to the best time to take it up. Trawls are generally fished during the night. Sharks are numerous and often destroy an entire trawl outfit.

Fish pots are used in from 20 to 25 fathoms of water. They are lifted once a day in removing the fish. The pots are of larger size than at most places, being 6 feet long, 3 feet wide, and 18 inches deep. The frame is of mangrove wood, and the body of split wild cane, woven in 2-inch, six-sided meshes. The body and frame are fastened together

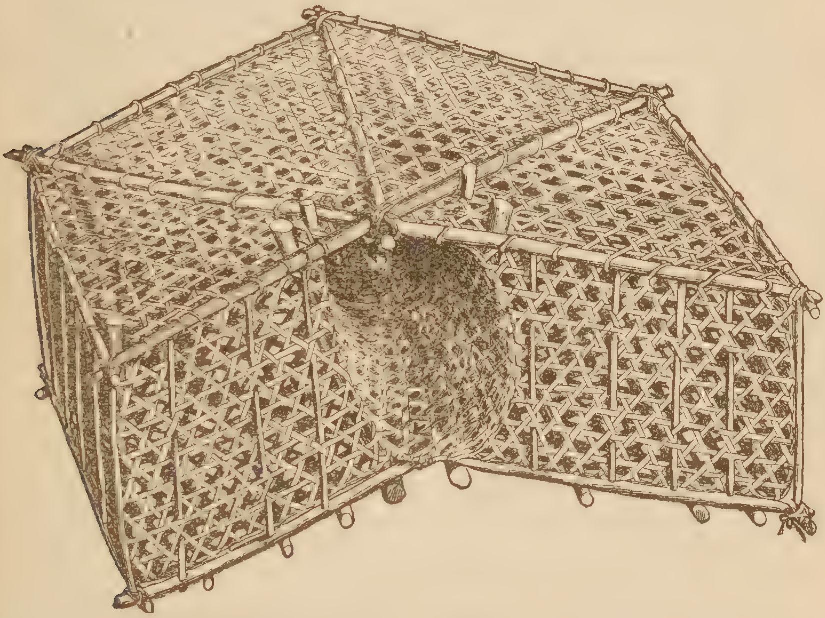


FISHING POT AND FISHERMEN, WITH THEIR FAMILIES, ARROYO.

FISHERMEN'S HOMES AND FISH NETS, AT PALO SECO, NEAR MOUTH OF BAYAMON RIVER

with calabash roots that are very strong and, after being water-soaked, pliable. A small door in the back of the pot permits the removal of the catch. No bait is used in the pots, as its presence attracts the numerous sharks which often destroy pots containing fish. These pots have a wide mouth, the entrance narrowing as it passes with a curve into the pot. Fish entrapped do not often escape, and serve as decoys to other fish. From 6 to 12 pots are used by each boat.

At Arroyo, as elsewhere, when under Spanish rule, exclusive privileges to fish in the most desirable localities were sold, and often included privileges for fishing in the rivers and their mouths. The records of the fisheries at this place were not saved by the former captain of the port. At present fishing is free and no record is made of men or of the catch.



Bamboo fish pot or trap in general use in Porto Rico.

The Patillas River, a small stream having its outlet a few miles east of Arroyo, is reported as being well supplied with fish, which are taken by weirs, haul seines, and cast nets.

The fresh and salt water fish taken in the vicinity of Arroyo are sold fresh from a few rough tables near the water front, or peddled through the country by men on foot and on horseback. As a rule prices are high to the consumers, ranging from 7 to 12 cents a pound for undressed fish. Imported dry fish are often cheaper than fresh fish and much more in demand.

PUNTA SANTIAGO.

This place is of some importance as a receiving and distributing point for the rich and thickly settled district of Humacao. The port has about 1,000 inhabitants, a custom-house, and a few stores. The town of Humacao is 5 miles inland. Large quantities of dry and fresh fish are consumed in the district, the former being received from Ponce and San Juan. Customs records show no direct imports of fish during the past five years.

The present collector of customs (formerly captain of the port) reports 25 fishermen, with the following apparatus:

6 sailboats, valued at $150	$900
3 rowboats, valued at $45	135
132 fish pots, valued at $3	396
12 cast nets, valued at $6	72
Total	1,503

During April, May, and June trolling lines and hooks are much used, but at other seasons trolling is limited to such times as going to and from the set pots. The principal part of the catch is from pots which are occasionally baited with fragments of crayfish or spiny lobsters, but as a rule pots are not baited. Crayfish are plentiful and at times the pots will be filled with them. When more are taken than can be disposed of the surplus is returned to the sea. When the pots are baited with broken-up crayfish, the catch is confined to fish, as no crayfish will then enter them. A small number of crayfish are taken at night by hand, among rocks in shallow water; a torch is used which attracts the crayfish and enables the fisherman to see and impale it with a forked stick.

The fish are sold fresh, undressed, supplying the local demand only. The fishermen receive 4 to 6 cents a pound. Crayfish are sold by the piece, the size governing the price, which averages 3 cents a pound. The largest weigh from 6 to 8 pounds. Occasionally fishermen dry a small amount of fish for their own use.

The only nets used at Santiago are a few cast nets for taking sardines and other small fish.

HUCARES.

This place is located near the center of the western end of Porto Rico, and is 4 miles north of Punta Santiago. Near the shore the water is shallow, necessitating the lighterage of cargoes. The port of Hucares is said to have a population of from 800 to 1,000, most of the men working on the plantations, while a few are fishermen. The village has a few fairly good houses, but the majority of them consist of a light frame of poles thatched with the leaves of the sugar cane and banana.

A number of small stores dispose of considerable dry fish, which comes from the importers of San Juan.

Fish are reported plentiful in the harbor, where they are taken by 10 fishermen, who use 4 boats, 60 pots, and trolling lines and hooks. Eight men with 1 boat occasionally use a haul seine 300 feet long, with a bag in the center. The fish catch is chiefly by pots.

FAJARDO, CEIBA, AND LUQUILLO.

Fajardo, located at the northeastern end of the island, with Ceiba, on the south 6 miles, and Luquillo, about the same distance on the northwest, are represented in the fisheries as follows:

Locality.	Apparatus.	Value.	Fishermen.
Fajardo	Boats, 24	$1,800	80
	Pots, 100	400	
	Cast nets, 12	60	
	Haul seines, 4	1,000	
	Turtle nets, 50	750	
		4,010	80
Ceiba	Boats, 6	450	15
	Pots, 15	60	
	Cast nets, 4	20	
		530	15
Luquillo	Boats, 2	150	5
	Pots, 15	60	
	Cast nets, 2	10	
		220	5

Fajardo, with a population of 4,000, is the most important place in this section, and is located 2 miles inland from the *playa* or landing. At the latter there are 600 inhabitants, a few small stores, and the custom-house, which, prior to the change of government, was a second-grade office at which no imports were permitted. A large amount of dry and fresh fish is consumed, the former coming from San Juan.

Fishing is chiefly by set pots; occasionally a few haul seines and cast nets are used in the general fishery, and gill nets for turtles. Trolling hooks and lines are used to a limited extent. Fish are plentiful and are all sold fresh, undressed, at about 4 cents a pound.

The boats are small, roughly built, with sloop or cat rig, none having wells. Haul seines are 300 feet long, with a bag in the center, and are hand-made. The mesh in the wings is 1½ and 2 inch, in the bag ½ inch. The twine is imported from Spain and is worth 36 cents a pound.

At certain seasons a light catch of fish is made in the Fajardo River, a few cast nets being used near its mouth. Within 6 miles of the mouth of the river 3 weirs have been fished in the past. The best fishing-grounds, near the mouth of the river, were formerly worked only by holders of special grants from the government.

Canned fish are not much used. The cost and retail prices of the few found on sale were as follows:

Description.	Cost.	Retail price per can.
	Per dozen.	*Cents.*
Sardines, ½ oil	$1.00	10
Salmon, 1-pound tall can	2.25	25
Oysters, 5-ounce can	2.25	25
Merluza (codfish), 1-pound flat can	2.50	30

A few turtles are caught about the adjacent islands, chiefly with gill nets 15 feet long, which have wooden decoys attached, representing turtles. During 1898, 400 pounds of hawksbill-turtle shells were taken and sent to New York, where the best brought $5 a pound in gold.

Small oysters are found attached to the roots and lower branches of the mangrove trees that border the islands, but none are gathered.

VIEQUES ISLAND.

Vieques Island is the largest in size and population of the several outlying islands belonging to Porto Rico. It is 17 miles long by 5 miles in greatest width, its western end being 11 miles from Porto Rico. The population in 1897 was about 5,200.

A small amount of fishing is carried on at several places. The following table gives all the statistics obtainable:

Location.	Men.	Boats.	Pots.
Porto Isabel II	12	6	50
Porto Real	4	2	12
Porto Negro	2	1	8
Porto Arenas	6	3	18
Porto Mosquito	6	3	20
Total	30	15	108

Trolling lines and a few nets are used, but most of the fishing is by set pots. The pots are anchored by ropes made of vines. The catch is peddled through the several small villages and at the plantations, selling at 5 cents a pound. A few turtles are taken at the southern end of the island. Small vessels from the neighboring British and Danish islands at times visit this section on their trips for turtles.

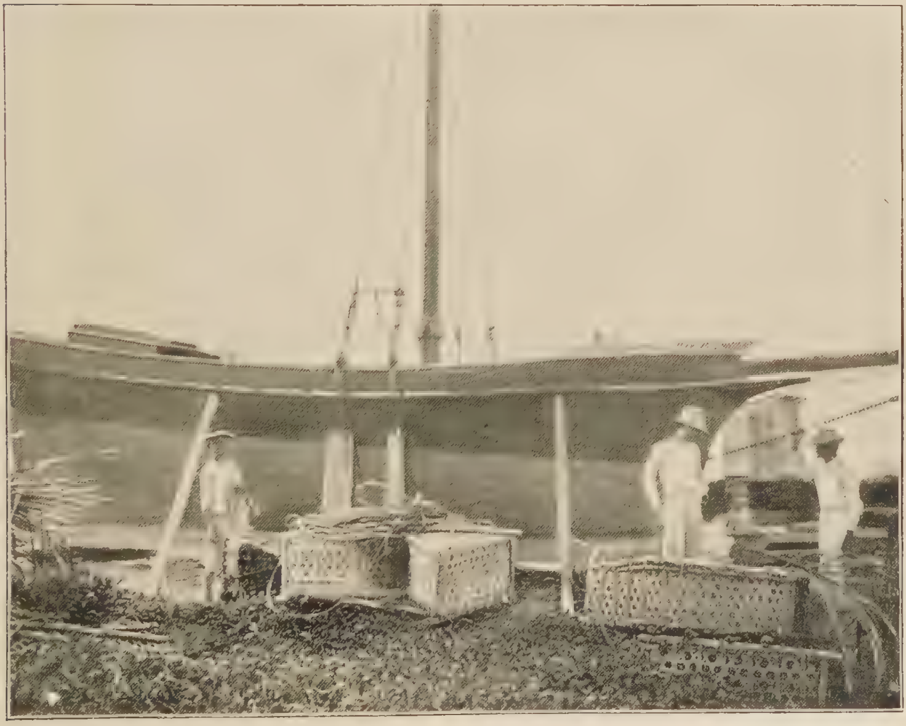
Isabel Segunda, on the north side of the island, has several good-sized stores, and is the leading port. Its harbor is much exposed, and dangerous with northerly winds. At this port the fishing appliances are 50 pots, 25 cast nets, and 1 haul seine. The latter is 150 feet long and 10 feet deep.

CULEBRA ISLAND.

Culebra Island is 10 miles north of Vieques Island, and 14 miles from Porto Rico. It is rough and mountainous, and is but little cultivated by its 730 inhabitants. It is of very irregular shape, with an extreme length of 8 miles and a width of 3 miles. The harbor is one of the very few good ones found in this section. It is nearly surrounded by high hills and has a good depth of water. The narrow entrance is bordered with coral reefs. On the harbor is a small settlement of about 100 inhabitants, with a few small stores.

Fish are reported plentiful around the island, but scarce inside the harbor. Very little attention is given to fishing, only 2 or 3 men being engaged. They use 12 fish pots, 24 nets for turtles, and occasionally trolling hooks and lines. Imported dry cod is much more used than fresh fish.

FISHERMEN AT AGUADILLA.



FISHING SCHOONER FRANCISCA AND WICKER FISHING POTS.

Nets for taking turtles are 27 feet long, 8 to 12 feet deep, of 12-inch square mesh; they are home-made, the twine being worth 50 cents a pound at St. Thomas. A few turtles are taken on the beaches, but most of the catch is by nets, which, with their wooden decoy turtles, are anchored near the coral reefs; the nets are visited once or twice a day during the turtle-fishing season, which is said to be in May, June, July, and August. The hawksbill, green sea, and loggerhead turtles are reported more plentiful in this vicinity than elsewhere in the region. The local catch is small, only 75 hawksbill turtles being caught in 1898.

The shell of the hawksbill is said to average from 3 to 5 pounds, and brings from 75 cents to $4 a pound in gold at St. Thomas. The loggerhead turtle is used only for its oil. Turtle meat of the other varieties is sold for food at 6 cents a pound.

Under Spanish rule fishing privileges around the island were free to the natives only. The natives claim that their fisheries have not been protected, the islands being visited by numerous small fishing craft owned at St. Thomas and other Danish and British islands. Since the change in government these vessels when in this vicinity fly the American flag, and their crews claim to be citizens of the United States, although the natives say most of these boats are owned at the British island of Tortola.

The fish are salted and poorly cured on board by drying in the sun, and are disposed of chiefly at St. Thomas and other ports in the West Indies. The catch is obtained by pots and trolling lines.

The turtle catch is said to be considerable.

The harbor of Culebra Island has numerous small inlets that are bordered with mangrove trees, on the roots and lower branches of which small-sized oysters are abundant, but are too small to be of much value for food.

STATISTICAL TABLES.

Imported fishery products being next to the largest in amount and value of the imports of Porto Rico, the statistical tables presented on pages 30–33 are of much interest and value. The records are from the original entries at the several custom-houses of the island. There the various species are not shown, but by reference to pages 4, 5, and 12, an analysis of the imports will be found, giving species and full particulars of imports.

In all cases where values are given it is on a basis of Spanish paper money, which has had a fluctuating value, the average during the time shown in the tables being some 60 cents on a dollar for gold.

Table showing, from countries received, the quantity, value, and duty paid on

Received from—	Dry, pickled, and smoked fish.				Canned fish.		
	Kilos.	Lbs.	Value.	Duty.	Kilos.	Lbs.	
1893.							
British North American provinces.	9,315,929	20,538,095	$1,211,070.77	$83,843.26	....	....	1
United States	356,190	785,264	46,304.70	1,676.59	15,323	33,781	2
Norway and Sweden	10,922	24,079	1,419.86	95.59	....	....	3
France	....	....	....	....	1,146	2,526	4
Spain	135,731	299,235	17,645.03	....	67,538	148,896	5
England	1,246	2,747	161.98	11.21	2,953	6,510	6
Germany	22,412	49,410	2,913.56	201.71	614	1,354	7
Total	9,842,430	21,698,830	1,279,515.90	85,828.36	87,574	193,067	8
1894.							
British North American provinces.	9,890,226	21,804,202	1,285,729.38	89,012.04	....	....	9
United States	1,522,207	3,355,890	197,886.91	....	38,489	84,854	10
Norway and Sweden	10,790	23,788	1,402.70	47.11	....	....	11
France	581	1,281	75.53	5.23	6,261	13,803	12
Spain	56,247	124,003	7,312.11	....	250,713	552,727	13
Italy	144	317	18.72	1.30	....	....	14
England	350	772	45.50	3.15	10,273	22,648	15
Germany	23,349	51,476	3,035.37	234.14	1,346	2,968	16
Holland	....	....	....	....	686	1,512	17
Total	11,503,894	25,361,729	1,495,506.22	89,302.97	307,768	678,512	18
1895.							
British North American provinces.	12,379,085	27,291,194	1,609,281.05	111,411.77	....	....	19
United States	769,401	1,696,238	100,022.13	6,900.50	879	1,938	20
Norway and Sweden	32,639	71,957	4,244.07	293.76	....	....	21
France	....	....	....	....	2,421	5,337	22
Spain	27,903	61,516	3,627.39	....	532,303	1,173,526	23
Italy	....	....	....	....	78	172	24
England	980	2,161	127.40	8.82	808	1,781	25
Germany	2,309	5,090	300.17	24.30	940	2,072	26
Denmark	7,645	16,854	993.85	68.81	....	....	27
Total	13,219,962	29,145,010	1,718,596.06	118,707.96	537,429	1,184,826	28
1896.							
British North American provinces.	11,974,462	26,399,153	1,556,680.06	107,770.16	....	....	29
French North American provinces.	70,270	154,919	9,135.10	632.43	....	....	30
United States	728,714	1,606,538	94,732.82	6,558.43	6,793	14,976	31
Norway and Sweden	45,974	101,355	5,976.62	413.77	....	....	32
France	5,840	12,875	759.20	52.56	4,231	9,328	33
Spain	86,369	190,411	11,227.97	....	248,137	547,048	34
Italy	....	....	....	....	36	79	35
England	754	1,662	98.02	6.79	3,630	8,003	36
Germany	16,237	35,797	2,110.81	146.13	360	794	37
Denmark	11	24	12.35	.86	....	....	38
Venezuela	20,500	45,195	2,665.00	184.50	....	....	39
Cuba	....	....	....	....	....	....	40
Total	12,949,131	28,547,929	1,683,397.95	115,765.63	263,187	580,228	41
1897.							
British North American provinces.	12,722,700	28,048,735	1,653,871.00	115,000.84	....	....	42
United States	2,226,750	4,909,141	288,958.60	20,080.67	1,964	4,330	43
Norway	44,443	97,958	5,776.29	399.92	....	....	44
Sweden	18,799	41,445	2,443.87	169.40	....	....	45
Scotland	391	862	50.83	3.53	....	....	46
France	2,542	5,604	330.46	22.88	4,567	10,068	47
Spain	75,523	166.499	9,817.99	2.21	296,194	652,996	48
Italy	920	2,028	119.60	8.24	143	316	49
England	70,520	155,470	9,867.60	634.68	17,126	37,756	50
Germany	9,834	21,680	1,278.42	88.54	382	842	51
Total	15,172,412	33,449,422	1,972,514.66	136,410.91	320,376	706,308	52

fishery products imported into Porto Rico during 1893, 1894, 1895, 1896, and 1897.

	Canned fish.		Shellfish.				Total.			
	Value.	Duty.	Kilos.	Lbs.	Value.	Duty.	Kilos.	Lbs.	Value.	Duty.
1	....	....	....	....	....	....	9,315,929	20,538,095	$1,211,070.77	$83,843.26
2	$7,661.50	$881.07	....	....	....	....	371,513	819,045	53,966.20	2,557.66
3	....	....	....	....	....	....	10,922	24,079	1,419.86	95.59
4	1,995.50	458.96	....	....	....	....	1,146	2,526	1,995.50	458.96
5	33,769.00	88.54	3,402	7,500	$272.16	$10.03	206,671	455,631	51,686.19	98.57
6	1,476.50	339.59	912	2,010	72.96	....	5,111	11,267	1,711.44	350.80
7	307.00	70.61	....	....	....	....	23,026	50,764	3,220.56	272.32
8	45,209.50	1,838.77	4,314	9,510	345.12	10.03	9,934,318	21,901,407	1,325,070.52	87,677.16
9	....	....	....	....	....	....	9,890,226	21,804,202	1,285,729.38	89,012.04
10	19,244.50	2,434.43	120	265	9.60	....	1,560,816	3,441,009	217,141.01	2,434.43
11	....	....	720	1,587	57.60	7.20	11,510	25,375	1,460.30	54.31
12	3,130.50	792.02	1,750	3,858	140.00	17.50	8,592	18,942	3,346.03	814.75
13	125,356.50	720.80	50	110	4.00	....	307,010	676,840	132,672.61	720.80
14	....	....	....	....	....	....	144	317	18.72	1.30
15	5,136.50	1,299.53	....	....	....	....	10,623	23,420	5,182.00	1,302.68
16	673.00	173.27	....	....	....	....	24,695	54,444	3,708.37	407.41
17	343.00	86.78	....	....	....	....	686	1,512	343.00	86.78
18	153,884.00	5,506.83	2,640	5,820	211.20	24.70	11,814,302	26,046,061	1,649,601.42	94,834.50
19	....	....	....	....	....	....	12,379,085	27,291,194	1,609,281.05	111,411.77
20	439.50	92.00	94	207	7.52	.75	770,374	1,698,383	100,469.15	6,993.25
21	....	....	....	....	....	....	32,639	71,957	4,244.07	293.76
22	1,210.50	278.41	....	....	....	....	2,421	5,337	1,210.50	278.41
23	266,151.50	2,800.00	4,481	9,879	358.48	....	564,687	1,244,921	270,137.37	2,800.00
24	39.00	8.97	....	....	....	....	78	172	39.00	8.97
25	404.00	92.90	....	....	....	....	1,788	3,942	531.40	101.72
26	470.00	107.00	....	....	....	....	3,249	7,162	770.17	131.30
27	....	....	....	....	....	....	7,645	16,854	993.85	68.81
28	268,714.50	3,379.28	4,575	10,086	366.00	.75	13,761,966	30,339,922	1,987,676.56	122,087.99
29	....	....	....	....	....	....	11,974,462	26,399,153	1,556,680.06	107,770.16
30	....	....	....	....	....	....	70,270	154,919	9,135.10	632.43
31	3,396.50	781.19	83	183	6.64	.83	735,590	1,621,697	98,135.96	7,340.45
32	....	....	....	....	....	....	45,974	101,355	5,976.62	413.77
33	2,115.50	486.57	....	....	....	....	10,071	22,203	2,874.70	539.13
34	124,068.50	....	23	51	1.84	....	334,529	737,510	135,298.31	....
35	18.00	4.14	....	....	....	....	36	79	18 00	4.14
36	1,815.00	417.45	....	....	....	....	4,384	9,665	1,913.02	424.24
37	180.00	41.40	....	....	....	....	16,597	36,591	2,290.81	187.53
38	....	....	....	....	....	....	11	24	12.35	.86
39	....	....	....	....	....	....	20,500	45,195	2,665.00	184.50
40	....	....	137	302	10.96	....	137	302	10.96	....
41	131,593.50	1,730.75	243	536	19.44	.83	13,212,561	29,128,693	1,815,010.89	117,497.21
42	....	....	....	....	....	....	12,722,700	28,048,735	1,653,871.00	115,000.84
43	982.00	225.89	115	253	8.00	1.15	2,228,829	4,913,724	289,948.60	20,307.71
44	....	....	....	....	....	....	44,433	97,958	5,776.29	399.92
45	....	....	....	....	....	....	18,799	41,445	2,443.87	169.40
46	....	....	....	....	....	....	391	862	50.83	3.53
47	2,283.50	530.37	....	....	....	....	7,109	15,672	2,613.96	553.25
48	139,317.50	429.16	....	....	....	....	371,717	819,495	149,135.49	431.37
49	71.50	17.49	....	....	....	....	1,063	2,344	191.10	25.73
50	8,563.30	2,002.45	....	....	....	....	87,646	193,226	18,430.90	2,637.13
51	191.00	43.93	....	....	....	....	10,216	22,522	1,469.42	132.47
52	151,408.80	3,249.29	115	253	8.00	1.15	15,492,903	34,155,983	2,123,931.46	139,661.35

Table showing, from countries received and by ports of entry, the quantity,

Imported from—	Ports of entry.	Dry, pickled, and smoked fish.				Canned fish.		
		Kilos.	Lbs.	Value.	Duty.	Kilos.	Lbs.	
British North American provinces.	Ponce	5,933,104	13,080,247	$771,303.52	$53,397.94	....	....	1
	San Juan	3,380,410	7,452,524	439,453.30	30,513.73	....	....	2
	Mayaguez	2,235,907	4,929,328	290,587.91	20,529.66	....	....	3
	Arecibo	1,173,279	2,586,636	152,526.27	10,559.51	....	....	4
	Total	12,722,700	28,048,735	1,653,871.00	115,000.84	....	....	5
United States	Ponce	1,807,480	3,984,809	234,972.50	16,267.31	332	732	6
	San Juan	268,729	592,446	34,934.77	2,438.38	1,612	3,554	7
	Mayaguez	122,903	270,955	15,458.39	1,122.33	20	44	8
	Aguadilla	19,965	44,015	2,595.45	183.58	....	....	9
	Arecibo	7,673	16,916	997.49	69.07	....	....	10
	Total	2,226,750	4,909,141	288,958.60	20,080.67	1,964	4,330	11
Norway	San Juan	44,433	97,958	5,776.29	399.92	....	....	12
Sweden	San Juan	18,799	41,445	2,443.87	169.40	....	....	13
Scotland	San Juan	391	862	50.83	3.53	....	....	14
France	Ponce	2,434	5,366	316.42	21.91	368	811	15
	San Juan	108	238	14.04	.97	3,789	8,353	16
	Mayaguez	....	....	....	....	410	904	17
	Total	2,542	5,604	330.46	22.88	4,567	10,068	18
Spain	Ponce	....	....	....	....	11,616	25,609	19
	San Juan	73,317	161,636	9,531.21	....	217,629	479,790	20
	Mayaguez	2,206	4,863	286.78	2.21	56,593	124,766	21
	Aguadilla	....	....	....	....	5,690	12,544	22
	Arecibo	....	....	....	....	4,666	10,287	23
	Total	75,523	166,499	9,817.99	2.21	296,194	652,996	24
Italy	Ponce	....	....	....	....	67	148	25
	San Juan	920	2,028	119.60	8.24	76	168	26
	Total	920	2,028	119.60	8.24	143	316	27
England	Ponce	70,421	155,252	9,854.73	633.79	16,430	36,222	28
	San Juan	99	218	12.87	.89	696	1,534	29
	Total	70,520	155,470	9,867.60	634.68	17,126	37,756	30
Germany	San Juan	9,834	21,680	1,278.42	88.54	382	842	31
	Grand total	15,172,412	33,449,422	1,972,514.66	136,410.91	320,376	706,308	32
Total	Ponce	7,813,439	17,225,674	1,016,447.17	70,320.95	28,813	63,522	33
	San Juan	3,797,040	8,371,035	493,615.20	33,623.60	224,184	494,241	34
	Mayaguez	2,361,016	5,205,146	306,333.08	21,654.20	57,023	125,714	35
	Aguadilla	19,965	44,015	2,595.45	183.58	5,690	12,544	36
	Arecibo	1,180,952	2,603,552	153,523.76	10,628.58	4,666	10,287	37
	Total	15,172,412	33,449,422	1,972,514.66	136,410.91	320,376	706,308	38

value, and duty paid on fishery products imported into Porto Rico in 1897.

	Canned fish.		Shellfish.				Total.			
	Value.	Duty.	Kilos.	Lbs.	Value.	Duty.	Kilos.	Lbs.	Value.	Duty.
1	....	....	....	....	....	....	5,933,104	13,080,247	$771,303.52	$53,397.94
2	....	....	....	....	....	....	3,380,416	7,452,524	439,453.30	30,513.73
3	....	....	....	....	....	....	2,235,907	4,929,328	290,587.91	20,529.66
4	....	....	....	....	....	....	1,173,279	2,586,636	152,526.27	10,559.51
5	....	....	....	....	....	....	12,722,700	28,048,735	1,653,871.00	115,000.84
6	$166.00	$38.17	....	....	....	....	1,807,812	3,985,541	235,138.50	16,305.48
7	806.00	185.42	115	253	$8.00	$1.15	270,456	596,253	35,748.77	2,624.95
8	10.00	2.30	....	....	....	....	122,923	270,999	15,468.39	1,124.63
9	....	....	....	....	....	....	19,965	44,015	2,595.45	183.58
10	....	....	....	....	....	....	7,673	16,916	997.49	69.07
11	982.00	225.89	115	253	8.00	1.15	2,228,829	4,913,724	289,948.60	20,307.71
12	....	....	....	....	....	....	44,433	97,958	5,776.29	399.92
13	....	....	....	....	....	....	18,799	41,445	2,443.87	169.40
14	....	....	....	....	....	....	391	862	50.83	3.53
15	184.00	42.31	....	....	....	....	2,802	6,177	500.42	64.22
16	1,894.50	435.78	....	....	....	....	3,897	8,591	1,908.54	436.75
17	205.00	52.28	....	....	....	....	410	904	205.00	52.28
18	2,283.50	530.37	....	....	....	....	7,109	15,672	2,613.96	553.25
19	5,808.00	....	....	....	....	....	11,616	25,609	5,808.00	....
20	108,814.50	....	....	....	....	....	290,946	641,426	118,345.71	....
21	19,517.00	429.16	....	....	....	....	58,799	129,629	19,803.78	431.37
22	2,845.00	....	....	....	....	....	5,690	12,544	2,845.00	....
23	2,333.00	....	....	....	....	....	4,666	10,287	2,333.00	....
24	139,317.50	429.16	....	....	....	....	371,717	819,495	149,135.49	431.37
25	33.50	7.70	....	....	....	....	67	148	33.50	7.70
26	38.00	9.79	....	....	....	....	996	2,196	157.60	18.03
27	71.50	17.49	....	....	....	....	1,063	2,344	191.10	25.73
28	8,215.30	1,922.91	....	....	....	....	86,851	191,474	18,070.03	2,556.70
29	348.00	79.54	....	....	....	....	795	1,752	360.87	80.43
30	8,563.30	2,002.45	....	....	....	....	87,646	193,226	18,430.90	2,637.13
31	191.00	43.93	....	....	....	....	10,216	22,522	1,469.42	132.47
32	151,408.80	3,249.29	115	253	8.00	1.15	15,492,903	34,155,983	2,123,931.46	139,661.35
33	14,406.80	2,011.09	....	....	....	....	7,842,252	17,289,196	1,030,853.97	72,332.04
34	112,092.00	754.46	115	253	8.00	1.15	4,021,339	8,865,529	605,715.20	34,379.21
35	19,732.00	483.74	....	....	....	....	2,418,039	5,330,860	326,065.08	22,137.94
36	2,333.00	....	....	....	....	....	25,655	56,559	5,440.45	183.58
37	2,845.00	....	....	....	....	....	1,185,618	2,613,839	155,856.76	10,628.58
38	151,408.80	3,249.29	115	253	8.00	1.15	15,492,903	34,155,983	2,123,931.46	139,661.35

CONCLUSION.

The change in the government of Porto Rico has been so recent that it will be some time before the old methods will become modified to suit new conditions, and so little is known of the local commercial fisheries of the island that predictions as to their future can not be safely made.

In supplying the island with the large amount of cured fish required annually, there will be changes by shippers and receivers in methods of handling, one of importance being a change from the long-time credit system. A knowledge of the coffee and sugar industries of the island is important to shippers, as return cargoes often have to be secured. The future imports of fishery products may reasonably be expected to come from sources that can lay them down at the lowest prices, and to some extent handle in return the products of the island.

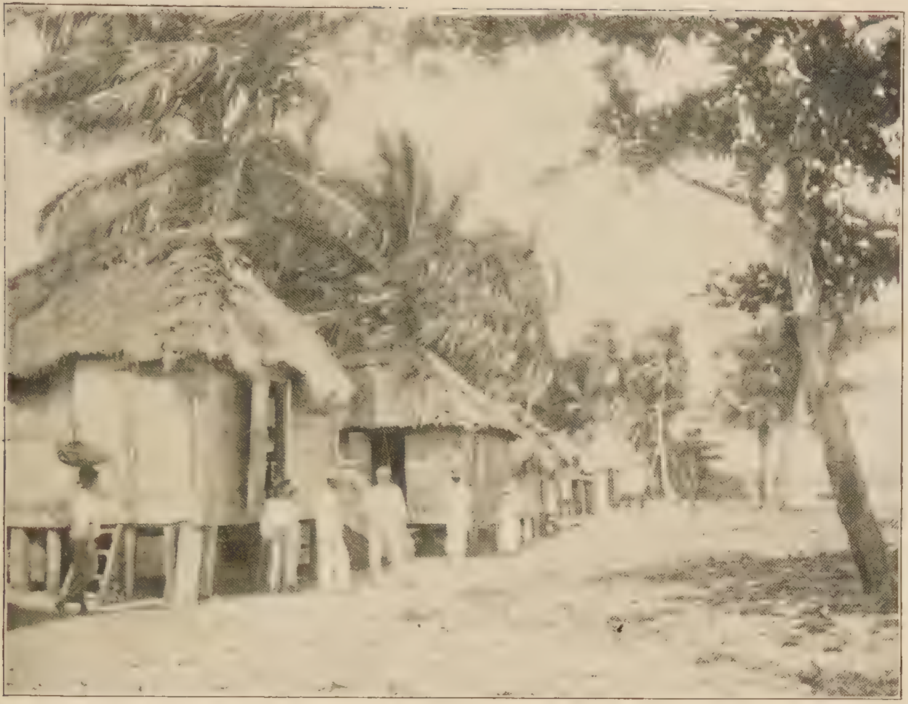
As the Porto Ricans are conservative and slow to experiment with unfamiliar articles, some time will be required to introduce boneless or other fish preparations unknown to them. They are quick to appreciate low prices, and when they come to understand the good qualities of boneless fish, canned fish, and similar foods prepared in the United States, a large demand for good articles, at reasonably low prices, may be expected.

The local fisheries may possibly prove to be of considerable value, but time and capital will be needed to develop them. Different methods of capture and more energy in the prosecution of the fisheries are necessary to determine if a large supply can be depended upon. The species best adapted for curing or canning are yet to be ascertained.

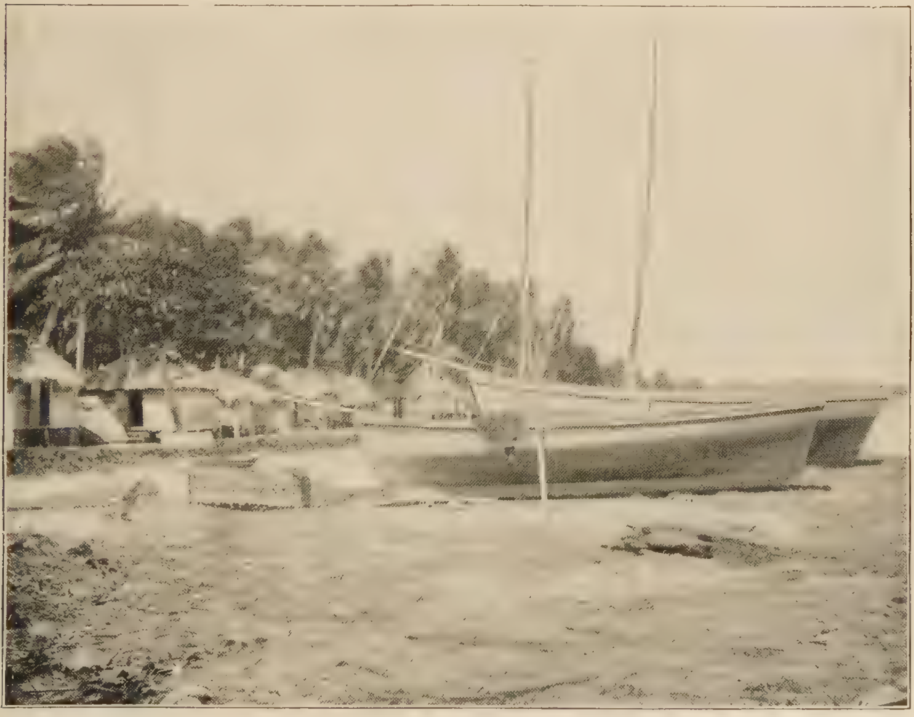
The entire absence of machine-made nets is to be noted. With the introduction of capital and the development of the fisheries, there would at once come a large demand for these goods. The few nets now used are hand-made by the poor fishermen, who are seldom able to buy more than a few balls of twine at a time. and no one has as yet seemed willing to advance capital or supplies to further increase the business.

A large variety of fine edible fish are found in the salt and fresh waters of Porto Rico, yet little attention is given to their capture and none to their cure. Only those living near the seacoast or some of the rivers ever have any fresh fish, and then only at high prices.

Cheap ice and quick transportation are two important factors in the fresh-fish business, and at present these are both lacking. Ice is to be procured at very few places, and the price, $12 to $15 a ton, is too high for its use in the fisheries. The few short lines of railroad have no express business, and no fresh fish are transported by rail. With few exceptions the common roads are so poor that merchandise has to be carried by pack animals. With improved transporting facilities and cheaper ice, the thickly settled interior could receive a more abundant supply of fresh-fish at more reasonable prices, to the benefit of both consumers and dealers.



FISHERMEN'S HOMES, PUNTA SANTIAGO.



FISHING BOATS AND FISHERMEN'S HOMES, PUNTA SANTIAGO.

CHECK-LIST OF THE FISHES OF FLORIDA.

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CHECK-LIST OF THE FISHES OF FLORIDA.

By B. W. Evermann and W. C. Kendall.

INTRODUCTION.

While studying the large collections of fishes recently made by the United States Fish Commission at Key West, Biscayne Bay, St. Johns River, Tarpon Springs, Tampa, and elsewhere in Florida, the present writers found it necessary to go over all the literature pertaining to the fishes of that State, particularly papers of a faunal character or which bear in any way upon the geographic distribution of Florida fishes.

The examination of this literature, the identification of the different species mentioned by the various writers, the reduction of these species to a common denominator, and the determination of the name which each must bear in the light of present ichthyological knowledge, have constituted a work fraught with many difficulties. In order that the results of so much labor may be preserved and be readily available for use in further studies of the fish fauna of Florida, it has seemed wise to publish this check-list of the fishes of Florida, in which the known geographic distribution in the State of each species is fully indicated.

The list includes all species of fishes known by us to occur in the fresh and brackish waters of Florida, and all salt-water species known from Florida waters within the depth limit of 1,000 fathoms. Under each species are given all the Florida localities from which it has been reported, and in the parenthesis following each locality are the name of the author reporting the species and the year when it was so reported.

In the bibliography which follows will be found the titles of all papers of a faunal nature pertaining to the fishes of Florida which we have been able to find. Some titles may have been overlooked, but it is believed that all the important ones have been included. The titles are arranged in chronological order and any reference in the text of the list can be easily located by means of the bibliography. When two or more papers on Florida fishes were published in the same year by an author the letter *a* is added to the second one cited, *b* to the third, and so on, to agree with the references in the text.

Several investigations bearing upon the geographic distribution of fishes in Floridian waters have been made, the results of which have not been published. The most important of these are the following:

In 1889 the U. S. Fish Commission steamer *Fish Hawk*, while engaged in experimental hatching of mullet and sheepshead at Punta Gorda and Punta Rassa, made a small collection of fishes in Charlotte Harbor. These have been studied by us and are referred to in this paper as having been collected by the *Fish Hawk*, as "*Fish Hawk* coll., 1889."

In February, 1895, while making certain investigations with reference to the establishment of a marine biological station on the coast of Florida, Dr. H. M. Smith collected a number of fishes at Lake Worth, Biscayne Bay, and elsewhere on the east coast of Florida. These specimens have been studied by us and are cited in this paper under "Smith coll., 1895."

In October and November, 1896, the present writers spent some time at Key West, Biscayne Bay, Tampa, and Tarpon Springs. Large collections of fishes were made which are referred to as "Evermann & Kendall coll., 1896."

During the early part of 1897 Mr. Charles B. Hudson was at Key West engaged in painting for the U. S. Fish Commission the important food-fishes found at that place. The specimens painted, and some others, were preserved and are referred to as "Hudson coll., 1897."

From January 15 to April 15, 1897, Dr. Kendall was on the St. Johns River studying the habits of the shad. Incidentally large collections of fishes were made. These we refer to as "Kendall coll., 1897."

In February, 1898, the *Fish Hawk* spent some days at Port Tampa, and collected a few fishes which are cited as "*Fish Hawk* coll., 1898."

BIBLIOGRAPHY.

1818. CHARLES A. LE SUEUR. Notes on American fishes. <Journ. Ac. Nat. Sci. Phila. 1818, 45.

1821. CHARLES A. LE SUEUR. Descriptions of a new genus and of several new species of fresh-water fish indigenous to the United States. <Journ. Ac. Nat. Sci. Phila. 1821, 2–8.

1822. CHARLES A. LE SUEUR. Descriptions of the five new species of the genus *Cichla* of Cuvier. <Journ. Ac. Nat. Sci. Phila. 1822, 214–221.

1824. CHARLES A. LE SUEUR. Description of several species of the Linnean genus *Raia* of North America. <Journ. Ac. Nat. Sci. Phila. 1824, 100–121.

1842. JAMES ELLSWORTH DE KAY. Zoology of New York, or the New York fauna. Class V. Fishes, 1842.

1855. JOHN EDWARD HOLBROOK. An account of several species of fish observed in Florida, Georgia, etc. <Journ. Ac. Nat. Sci. Phila. 1855, vol. III, second series, part I, 47–57.

1855*a*. JOHN EDWARD HOLBROOK. Ichthyology of South Carolina, 1855, pp. 1–176.

1859. CHARLES GIRARD. Ichthyological notices. <Proc. Ac. Nat. Sci. Phila. 1859, 57–68.

1859*a*. CHARLES GIRARD. Ichthyological notices. <Proc. Ac. Nat. Sci. Phila. 1859, 157–161.

1859. ALBERT GÜNTHER. Catalogue of the fishes in the British Museum, vol. I, 1859, I–XXXII and 1–524.

1860. JOHN EDWARD HOLBROOK. Ichthyology of South Carolina, 1860, 1–205.

1863. THEODORE GILL. Description of new Pediculati, and on the classification of the group. <Proc. Ac. Nat. Sci. Phila. 1863, 88–92.

1863*a*. THEODORE GILL. Description of a new generic type of Ophidioids. <Proc. Ac. Nat. Sci. Phila. 1863, 209–211.

1864. ALBERT GÜNTHER. Catalogue of the fishes in the British Museum, vol. V, 1864, I–XXII, and 1–455.

1870. E. D. COPE. Observations on some fishes new to the American fauna found at Newport, R. I., by Samuel Powell. <Proc. Ac. Nat. Sci. Phila. 1870, 118–121.

1871. EDWARD D. COPE. Contributions to the ichthyology of the Lesser Antilles. <Trans. Am. Phil. Soc. 1871, 445–483.

1874. F. W. PUTNAM. Notes on Ophidiidæ and Fierasferidæ, with descriptions of new species from America and the Mediterranean. <Proc. Bost. Soc. Nat. Hist. 1874, 339–348.

1877. E. D. COPE. On some new and little-known reptiles and fishes from the Austroriparian region. <Proc. Am. Phil. Soc. 1877, 63–68.

1877. DAVID S. JORDAN. Contributions to North American Ichthyology, No. 2. <Bull. x, U. S. Nat. Mus. 1–120, 1877.

1878. DAVID S. JORDAN. Contributions to North American Ichthyology, No. III, Bull. XII, U. S. Nat. Mus., 1–237, 1878.

1878. Lieut. J. P. JEFFERSON, Dr. JOSEPH Y. PORTER, AND THOMAS MOORE. On the destruction of fish in the vicinity of the Tortugas during the months of September and October, 1878. <Proc. U. S. Nat. Mus. 1878, 244–246.

1878. G. BROWN GOODE. A revision of the American species of the genus *Brevoortia*, with a description of a new species from the Gulf of Mexico. <Proc. U. S. Nat. Mus. 1878, 30–42.

1878. G. BROWN GOODE AND TARLETON H. BEAN. Description of *Caulolatilus microps*, a new species of fish from the Gulf coast of Florida. <Proc. U. S. Nat. Mus. 1878, 42–45.

1878*a*. G. BROWN GOODE AND TARLETON H. BEAN. On a new Serranoid fish, *Epinephelus drummond-hayi*, from the Bermudas and Florida. <Proc. U. S. Nat. Mus. 1878, 173–175.

1878*b*. G. BROWN GOODE AND TARLETON H. BEAN. Descriptions of two new species of fishes (*Lutjanus blackfordii* and *L. stearnsii*) from the coast of Florida. <Proc. U. S. Nat. Mus. 1878, 176–181.

1878*c*. G. BROWN GOODE AND TARLETON H. BEAN. A note upon the black grouper (*Epinephelus nigritus* (Holbrook) Gill) of the southern coast. <Proc. U. S. Nat. Mus. 1878, 182–184.

1878. SILAS STEARNS. A note on the Gulf menhaden, *Brevoortia patronus* Goode. <Proc. U. S. Nat. Mus. 1878, 181–182.

1879. G. BROWN GOODE. A study of the trunk-fishes (*Ostraciontidæ*), with notes on the American species of the family. <Proc. U. S. Nat. Mus. 1879, 261–283.

1879*a*. G. BROWN GOODE. A preliminary catalogue of the fishes of the St. Johns River and the east coast of Florida, with descriptions of a new genus and three new species. <Proc. U. S. Nat. Mus. 1879, 108–121.

1879. G. BROWN GOODE AND TARLETON H. BEAN. Description of a new species of amber-fish (*Seriola stearnsii*) obtained near Pensacola, Fla., by Mr. Silas Stearns. <Proc. U. S. Nat. Mus. 1879, 48–51.

1879*a*. G. BROWN GOODE AND TARLETON H. BEAN. A catalogue of a collection of fishes from Pensacola, Fla., and vicinity sent by Mr. Silas Stearns, with descriptions of six new species. <Proc. U. S. Nat. Mus. 1879, 121–156.

1879*b*. G. BROWN GOODE AND TARLETON H. BEAN. Catalogue of a collection of fishes obtained in the Gulf of Mexico by Dr. J. W. Velie, with descriptions of seven new species. <Proc. U. S. Nat. Mus. 1879, 333–345.

1879. DAVID S. JORDAN. Description of new species of North American fishes. <Proc. U. S. Nat. Mus. 1879, 235–241.

1880. TARLETON H. BEAN. Check-list of duplicates of North American fishes distributed by the Smithsonian Institution in behalf of the U. S. National Museum, 1877–1880. <Proc. U. S. Nat. Mus. 1880, 75–116.

1880. DAVID S. JORDAN. Notes on a collection of fishes from East Florida obtained by Dr. J. A. Henshall. <Proc. U. S. Nat. Mus. 1880, 17–21.

1880*a*. DAVID S. JORDAN. Notes on a collection of fishes from St. Johns River, Florida, obtained by Mr. A. H. Curtiss. <Proc. U. S. Nat. Mus. 1880, 22.

1880. SAMUEL GARMAN. New species of Selachians in the Museum collection. <Bull. M. C. Z., No. 11, 167–172, 1880.

1881. G. BROWN GOODE. The Carangoid fishes of the United States—pompanoes, crevalles, amber-fish, etc. <Bull. U. S. Fish Com. 1881, 30–43.

1881. Samuel Garman. Reports on the results of dredging, under the supervision of Alexander Agassiz, along the Atlantic coast of the United States during the summer of 1880 by the U. S. Coast Survey steamer *Blake*, Commander J. R. Bartlett, U. S. N., commanding. XII. Report on the Selachians, by Samuel Garman. <Bull. M. C. Z., No. 11, 231–237, 1881.

1882. G. Brown Goode and Tarleton H. Bean. Description of twenty-five new species of fish from the southern United States, and three new genera, *Letharchus*, *Ioglossus*, and *Chriodorus*. <Proc. U. S. Nat. Mus. 1882, 412–437.

1882. Tarleton H. Bean and H. G. Dresel. Diagnosis of three new species of fishes from the Gulf of Mexico. <Proc. Biol. Soc. Washington 1882, 99–100.

1882. David S. Jordan and Charles H. Gilbert. Notes on fishes observed about Pensacola, Fla., and Galveston, Tex., with description of new species. <Proc. U. S. Nat. Mus. 1882, 241–307.

1882*a*. David S. Jordan and Charles H. Gilbert. Notes on a collection of fishes from Charleston, S. C., with descriptions of three new species. <Proc. U. S. Nat. Mus. 1882, 580–620.

1882. Joseph Swain. A review of the *Syngnathinæ* of the United States, with a description of one new species. <Proc. U. S. Nat. Mus. 1882, 307–315.

1882*a*. Joseph Swain. A review of the species of *Stolephorus* found on the Atlantic coast of the United States. <Bull. U. S. Fish Com. 1882, 55–57.

1882. Felipe Poey. List of food-fishes brought from Key West, Fla., into the markets of Havana. <Bull. U. S. Fish Com. 1882, 118.

1883. Tarleton H. Bean. Catalogue of the collection of fishes exhibited by the U. S. National Museum. <Rept. upon exhibit of United States made at London, Bull. 27, U. S. Nat. Mus., 387–510, 1883.

1883. Barton W. Evermann and Seth E. Meek. A review of the species of the genus *Gerres*. <Proc. Ac. Nat. Sci. Phila. 1883, 116–124.

1883. David S. Jordan and Charles H. Gilbert. Description of two new species of fishes (*Aprion ariommus* and *Ophidium beani*) from Pensacola, Fla. <Proc. U. S. Nat. Mus. 1883, 142–144.

1883*a*. David S. Jordan and Charles H. Gilbert. A review of the American *Caranginæ*. <Proc. U. S. Nat. Mus. 1883, 188–207.

1883*b*. David S. Jordan and Charles H. Gilbert. Synopsis of the fishes of North America, as Bull. 16, U. S. Nat Mus., I–LVI + 1–1018, 1882 (1883).

1883. H. D. Pierce. The spawning of bluefish—an opinion of the cause of mortality of fish in the Gulf of Mexico. <Bull. U. S. Fish Com. 1883, 332.

1884. H. G. Dresel. Description of a new species of flounder (*Citharichthys macrops*) from Pensacola, Fla. <Proc. U. S. Nat. Mus. 1884, 539–541.

1884. G. Brown Goode and Tarleton H. Bean. Notes on some Florida fishes (*Lutjanus stearnsii*, *L. blackfordii*, *Caulolatilus microps*, *Xyrichthys psittacus*, *Sparus pagrus*). <Proc. U. S. Nat. Mus. 1884, 42–47.

1884. David S. Jordan. Notes on a collection of fishes from Pensacola, Fla., obtained by Silas Stearns, with descriptions of two new species (*Exocœtus volador* and *Gnathypops mystacinus*). <Proc. U. S. Nat. Mus. 1884, 33–40.

1884*a*. David S. Jordan. List of fishes collected at Key West, Fla., with notes and descriptions. <Proc. U. S. Nat. Mus. 1884, 103–150.

1884*b*. David S. Jordan. An identification of the figures of fishes in Catesby's Natural History of Carolina, Florida, and the Bahama Islands. <Proc. U. S. Nat. Mus. 1884, 190–199.

1884*c*. David S. Jordan. List of fishes collected in Lake Jessup and Indian River, Florida, by Mr. R. E. Earll, with descriptions of two new species (*Heterandria ommata* and *Elassoma evergladei*). <Proc. U. S. Nat. Mus. 1884, 322–324.

1884*d*. David S. Jordan. The fishes of Florida Keys. <Bull. U. S. Fish Com. 1884, 77–80.

1884*e*. David S. Jordan. List of fishes from Egmont Key, Florida, in the museum of Yale College, with description of two new species. <Proc. Ac. Nat. Sci. Phila. 1884, 42–46.

1884*f*. David S. Jordan. Supplementary notes on North American fishes. <Proc. U. S. Nat. Mus. 1884, 545–548.

1884*g*. Note on *Ælurichthys eydouxii* and *Porichthys porosissimus*. < Proc. U. S. Nat. Mus. 1884, 40–41.

1884. David S. Jordan and Charles H. Gilbert. A review of the species of the genus *Calamus*. <Proc. U. S. Nat. Mus. 1884, 14–24.

1884*a*. David S. Jordan and Charles H. Gilbert. Descriptions of ten new species of fishes from Key West, Fla. <Proc. U. S. Nat. Mus. 1884, 24–32.

1884*b*. David S. Jordan and Charles H. Gilbert. Notes on *Calamus providens*, a new species of *Calamus*. <Proc. U. S. Nat. Mus. 1884, 150.

1884. David S. Jordan and Seth E. Meek. List of fishes observed in St. Johns River at Jacksonville, Fla. <Proc. U. S. Nat. Mus. 1884, 235–237.

1884. David S. Jordan and Joseph Swain. Descriptions of Scaroid fishes from Havana and Key West, including five new species (*Scarus virginalis, Sparisoma lorito, S. cyanolene, S. xystrodon, Cryptotomus beryllinus*). <Proc. U. S. Nat. Mus. 1884, 81–102.

1884*a*. David S. Jordan and Joseph Swain. Notes on fishes collected by David S. Jordan at Cedar Keys, Florida. <Proc. U. S. Nat. Mus. 1884, 230–234.

1884*b*. David S. Jordan and Joseph Swain. A review of the American species of marine *Mugilidæ*. <Proc. U. S. Nat. Mus. 1884, 261–275.

1884*c*. David S. Jordan and Joseph Swain. A review of the species of the genus *Hæmulon*. <Proc. U. S. Nat. Mus. 1884, 281–317.

1884*d*. David S. Jordan and Joseph Swain. A review of the American species of *Epinephelus* and related genera. <Proc. U. S. Nat. Mus. 1884, 358–410.

1884*e*. David S. Jordan and Joseph Swain. A review of the species of *Lutjaninæ* and *Hoplopogrinæ* found in American waters. <Proc. U. S. Nat. Mus. 1884, 427–474.

1884*f*. David S. Jordan and Joseph Swain. Description of three new species of fishes (*Prionotus stearnsi, P. ophryas*, and *Anthias vivanus*) collected at Pensacola, Fla., by Mr. Silas Stearns. <Proc. U. S. Nat. Mus. 1884, 541–545.

1884. Joseph Swain and Seth E. Meek. Notes on the pipefishes of Key West, Fla., with description of *Siphostoma mckayi*, a new species. <Proc. U. S. Nat. Mus. 1884, 237–239.

1884. Seth E. Meek. A review of the species of the genus *Synodus*. <Proc. Ac. Nat. Sci. Phila. 1884, 130–136.

1884. Seth E. Meek and David K. Goss. A review of the American species of the genus *Trachynotus*. <Proc. Ac. Nat. Sci. Phila. 1884, 121–129.

1884. Barnet Phillips. Notes on a trip in the Gulf of Mexico. <Bull. U. S. Fish Com. 1884, 144.

1884. Wm. Hamlin. Reconnaissance of Florida rivers with a view to shad-hatching. <Bull. U. S. Fish Com. 1884, 206–208.

1885. Tarleton H. Bean. On *Stathmonotus*, a new genus of fishes related to *Murænoides*, from Florida. <Proc. U. S. Nat. Mus. 1885, 191–192.

1885*a*. Tarleton H. Bean. Note on *Stoasodon narinari* Euphrasen. <Proc. U. S. Nat. Mus. 1885, 192–193.

1885. G. Brown Goode and Tarleton H. Bean. Descriptions of new fishes obtained by the U. S. Fish Commission, mainly from deep water off the Atlantic and Gulf coasts. <Proc. U. S. Nat. Mus. 1885, 589–605.

1885. O. P. Hay. Notes on a collection of fishes from Florida, with descriptions of new or little-known species. <Proc. U. S. Nat. Mus. 1885, 552–559.

1885. J. W. Collins. The red-snapper grounds in the Gulf of Mexico. <Bull. U. S. Fish Com. 1885, 145–146.

1886. David S. Jordan. Notes on some fishes collected at Pensacola by Mr. Silas Stearns, with description of one new species (*Chætodon aya*). <Proc. U. S. Nat. Mus. 1886, 225–229.

1886. David S. Jordan and Charles L. Edwards. A review of the American species of *Tetradontidæ*. <Proc. U. S. Nat. Mus. 1886, 230–247.

1886. David S. Jordan and Carl H. Eigenmann. A review of the *Gobiidæ* of North America. <Proc. U. S. Nat. Mus. 1886, 477–518.

1886*a*. David Starr Jordan and Carl H. Eigenmann. A review of the *Sciænidæ* of America and Europe. <Report U. S. Fish Com. 1886 (1889), 343–351.

1886. David S. Jordan and Barton W. Evermann. Description of six new species of fishes from the Gulf of Mexico, with notes on other species. <Proc. U. S. Nat. Mus. 1886, 466–476.

1886. David S. Jordan and Morton W. Fordice. A review of the American species of *Belonidæ*. <Proc. U. S. Nat. Mus. 1886, 339–361.

1886. David S. Jordan and Elizabeth G. Hughes. A review of the genera and species of *Julidinæ* found in American waters. <Proc. U. S. Nat. Mus. 1886, 56–70.

1886*a*. David S. Jordan and Elizabeth G. Hughes. A review of the species of the genera *Prionotus*. <Proc. U. S. Nat. Mus. 1886, 327–338.

1886. Charles H. Bollman. Notes on a collection of fishes from the Escambia River, with description of a new species (*Zygonectes escambiæ*). <Proc. U. S. Nat. Mus. 1886, 462–465.

1886. David Starr Jordan and David Kop Goss. A review of the flounders and soles (*Pleuronectidæ*) of America and Europe. <Report U. S. Fish Com. 1886 (1889), 225–342.

1886. Barton W. Evermann and Seth E. Meek. A revision of the American species of the genus *Gerres*. <Proc. Ac. Nat. Sci. Phila. 1886, 256–272.

1886. J. W. Collins. Notes on the red-snapper fishery. <Bull. U. S. Fish Com. 1886, 299–300.

1886. Joseph Willcox. Fish killed by cold along the Gulf of Mexico and coast of Florida. <Bull. U. S. Fish Com. 1886, 123.

1886. G. Brown Goode and Tarleton H. Bean. Description of thirteen species and two genera of fishes from the *Blake* collection. <Bull. M. C. Z., vol. XII, No. 5, 1886, 153–170.

1887. Albert Günther. Report on the deep-sea fishes collected by H. M. S. *Challenger* during the years 1873–1876. <Deep Sea Fishes, *Challenger*, XXII, 1887, I–LXV+1–335, pls. I–LXXIII.

1887. J. W. Collins. Notes on the occurrence of mackerel off the coast of Florida. <Bull. U. S. Fish Com. 1887, 128.

1887. Angelo Heilprin. Additions to the Floridian fauna. <Trans. Wagner Inst. Sci. Phila., I, 1887, 129, 130.

1887. Carl H. Eigenmann. Description of a new species of *Ophichthys* (*Ophichthys retropinnis*) from Pensacola, Fla. <Proc. U. S. Nat. Mus. 1887, 116.

1887. Carl H. Eigenmann and Jennie E. Horning. A review of the *Chætodontidæ* of North America. <Annals N. Y. Ac. Sci., vol. IV, 1887, 1–18.

1887. Carl H. Eigenmann and Elizabeth G. Hughes. A review of the North American species of the genera *Lagodon*, *Archosargus*, and *Diplodus*. <Proc. U. S. Nat. Mus. 1887, 65–74.

1887. David Starr Jordan. Description of a new species of *Callionymus* (*Callionymus bairdi*) from the Gulf of Mexico. <Proc. U. S. Nat. Mus. 1887, 501–502.

1887*a*. David Starr Jordan. Description of a new species of *Xyrichthys* (*Xyrichthys jessiæ*) from the Gulf of Mexico. <Proc. U. S. Nat. Mus. 1887, 698.

1887*b*. David Starr Jordan. A review of the labroid fishes of America and Europe. <Report U. S. Fish Com. 1887 (1891), 599–699.

1888. David Starr Jordan and Bradley Moore Davis. A preliminary review of the apodal fishes or eels inhabiting the waters of America and Europe. <Report U. S. Fish Com. 1888 (1892), 581–677.

1888. David Starr Jordan and Carl H. Eigenmann. A review of the genera and species of *Serranidæ* found in the waters of America and Europe. <Bull. U. S. Fish Com. 1888 (1892), 329–441.

1888. Charles Harvey Bollman. A review of the *Centrarchidæ*, or fresh-water sunfishes, of North America. <Report U. S. Fish Com. 1888 (1892), 557–579.

1888. Carl H. Eigenmann and Rosa Smith Eigenmann. A list of the American species of *Gobiidæ* and *Callionymidæ*, with notes on the specimens contained in the Museum of Comparative Zoology at Cambridge, Mass. <Proc. Cal. Ac. Sci. 1888, 51–78.

1889. Charles H. Gilbert. Description of a new species of eel (*Sphagebranchus kendalli*), in Adams and Kendall, Report upon an investigation of the fishing-grounds off the west coast of Florida. <Bull. U. S. Fish Com. 1889 (1891), 310.

1889. W. C. Kendall. Lists of Brachyura, Mollusca, and Fishes, in Adams and Kendall, Report upon an investigation of the fishing-grounds off the west coast of Florida. <Bull. U. S. Fish Com. 1889 (1891), 289–312.

1889. James A. Henshall. Report upon a collection of fishes made in southern Florida during 1889. <Bull. U. S. Fish Com. 1889 (1891), 371–389.

1890. Albert J. Woolman. Report upon the rivers of central Florida, tributary to the Gulf of Mexico, with lists of fishes inhabiting them. <Bull. U. S. Fish Com. 1890, 293–302.

1892. Tarleton H. Bean. Description of a new species of star-gazer (*Cathetostoma albigutta*) from the Gulf of Mexico. <Proc. U. S. Nat. Mus. 1892, 121–122.

1894. Barton A. Bean. Scientific results of explorations by the U. S. Fish Commission steamer *Albatross*. <Proc. U. S. Nat. Mus. 1894, 633–636.

1894. E. A. Andrews. An undescribed acraniate, *Asymmetron lucayanum*. <Studies from the Biological Laboratory of the Johns Hopkins University, vol. V, No. 4, 213–247, pls. XIII, XIV, 1894.

1894. Einar Lönnberg. Notes on Florida fishes. <Ofvers Vet. Akad. Forh. 1894, 115–118.

1894. James A. Henshall. Notes on fishes collected in Florida in 1892. <Bull. U. S. Fish Com. 1894 (1895), 209–221.

1895. Hugh M. Smith. Notes on Biscayne Bay, Florida, with reference to its adaptability as the site of a marine hatching and experiment station. <Rept. U. S. Fish Com. 1895, 169–181.

1895. Barton W. Evermann. Description of a new species of shad (*Alosa alabamæ*) from Alabama. <Rept. U. S. Fish Com. 1895 (1896), 203–205.

1896. Samuel Garman. Report on the fishes collected by the Bahama expedition of the State University of Iowa under Prof. C. C. Nutting in 1893. <Bull. Lab. Nat. Sci. State Univ. Iowa, IV, No. 1, 76–93, pls. I–IV, 1896.

1896. David Starr Jordan and Barton Warren Evermann. Fishes of North and Middle America, vol. I, 1-1240, 1896, being part I, Bull. 47, U. S. Nat. Mus.

1896. George Brown Goode and Tarleton H. Bean. Oceanic Ichthyology. <U. S. Nat. Mus. Special Bull. No. 2, pp. I–XXXV and 1–553, pls. I–CXXII, 1896.

1896. Barton W. Evermann and Barton A. Bean. Indian River and its fishes. <Senate Doc. No. 46, 54th Cong., 2d sess., also in Report U. S. Fish Com. 1896 (1897), 227–248, pl. 23–59.

1897. John J. Brice. The fish and fisheries of the coastal waters of Florida. <Senate Doc. No. 100, 54th Cong., 2d sess., also in Report U. S. Fish Com., 1896 (1897), 263–342.

1897. Barton W. Evermann and William C. Kendall. Descriptions of new or little-known genera and species of fishes of the United States. <Bull. U. S. Fish. Com. 1897 (1898), 125–133, pls. 6–9.

1898. Barton Warren Evermann. The fish fauna of Florida. <Bull. U. S. Fish Com. 1897 (1899), 201–208; also in the Fishing Gazette, vol. XVI, No. 1, Jan. 7, 1899, and No. 2, Jan. 14, 1899, pp. 1, 2, 17, and 18; also in the Southern Sportsman, vol. II, No. 1, Jan., 1899, 9-14.

1898. David Starr Jordan and Barton Warren Evermann. Fishes of North and Middle America, vol. II, 1241–2183, and vol. III, 2184–3136, 1898, being parts II and III, Bull. 47, U. S. Nat. Mus.

THE FISHES OF FLORIDA.

From the list which follows it will be seen that the total number of species of fishes known from Floridian waters is 576, or more than one-sixth of the entire fish fauna of America north of Panama. This number is far larger than can be found in any other section of our country, and is due to the diversity and peculiarities of the climatic conditions prevailing there. The Florida fish fauna may be regarded as made up of at least five more or less distinct faunas: (*a*) the salt-water fauna of our South Atlantic States, (*b*) the subtropical fauna of the Florida Keys, (*c*) the Gulf of Mexico fauna, (*d*) the fresh-water fauna of the southern portion of the Lower Mississippi Valley, and (*e*) the fresh-water fauna of the Everglades.

These, of course, overlap more or less, and in a consideration of the entire fish fauna of America these regions would not be regarded as constituting distinct faunal areas; but for our present purpose they may properly be considered as fairly distinct. From Fernandina southward to Biscayne Bay are found most of the species characteristic of the coast south of Cape Hatteras. From Biscayne Bay to Key West and the Tortugas is found a fish fauna marvelous in its multitude of species and in richness of coloration.

Among the fishes of Florida which deserve special mention are the great numbers of groupers, snappers, grunts, and porgies, all important food-fishes; the many labroid species, such as the hog-fish, pudding-wife, and the various parrot-fishes, all remarkable for their brilliant coloration; the many species of pipe-fishes, the tangs, angel-fish, and chætodonts, among them several of the most gorgeous of American fishes.

The fish fauna of the Florida Keys resembles that of Cuba very closely. Many of the food and game fishes at Key West are also found at Havana. The warm waters of the keys serve as a more or less effective barrier to the passage of fishes living in colder water. As a result many species are found on the east coast of Florida which do not occur on the Gulf coast, and vice versa. There are so many species found on the west coast of Florida that are not known from the east side that the two coasts may be regarded as having separate faunas. This west-coast fauna extends from the "bay" to Pensacola and beyond, and is not essentially different from that found elsewhere on the coast of the Gulf of Mexico.

In the fresh waters of the northern part of the State the fishes are essentially the same as occur in the streams and ponds of the other Gulf States, and include several species of minnows, sun-fishes, catfishes, suckers, the bowfin or "grindle," and a few darters. From the little that is known about the fresh-water fishes of the extreme southern part of the State, it is believed that the species are to a considerable extent distinct and peculiar to that region. There is great need, however, of further investigation in this region.

Of the 576 species of fishes credited to Florida waters, about 61 are fresh-water species, 20 may be regarded as brackish-water species, and the remaining 495 constitute the salt-water fish fauna of the State.

FRESH-WATER SPECIES.

The number of fresh-water species known from the State is not large. They belong to the following families:

Petromyzonidæ (Lampreys)	1
Lepisosteidæ (Gars)	3
Amiidæ (Bowfins)	1
Siluridæ (Cat-fishes)	8
Catostomidæ (Suckers)	2
Cyprinidæ (Minnows)	9
Luciidæ (Pikes)	2
Pœciliidæ (Killi-fishes)	13
Aphredoderidæ (Pirate Perches)	1
Atherinidæ (Silversides)	1
Elassomidæ (Pigmy Sun-fishes)	1
Centrarchidæ (Sun-fishes and Basses)	15
Percidæ (Darters)	4

Of these 61 species the only ones of commercial importance are the cat-fishes, pikes, sun-fishes, and large-mouthed black bass. This list is remarkable in that it contains so few of the *Catostomidæ*, *Cyprinidæ*, and *Percidæ*. Each of these is a very large family, the approximate number of species of each in American waters being as follows: *Catostomidæ*, 67; *Cyprinidæ*, 227; *Percidæ*, 86.

The most southern locality in Florida from which specimens of fresh-water fishes have been obtained is Miami, 8 species having been collected there in the Miami and Little rivers in 1896. Doubtless many additional species will be discovered when the waters of the State are more thoroughly explored. The regions which promise the richest and most important results are the Everglades, the lakes in the interior south of Lake George, and the streams crossing the northern boundary of the State.

BRACKISH-WATER SPECIES.

In this category may be included all those species which live habitually in brackish water, those more truly salt-water species which are also found more or less commonly in brackish and even fresh water, and also those more truly fresh-water species which are occasionally found in brackish water. In this division will fall, of course, all anadromous and catadromous species, such as the shad and common eel. The family with the greatest number of species in this division is the *Pœciliidæ*, preeminently the family of brackish-water fishes. Florida contains 21 species of this family, of which at least 8 live habitually in brackish water and each of the other 13 may occasionally occur there. This family is worthy of note as containing the smallest known fish, *Heterandria formosa*. which is less than an inch in length.

Two species of shad are known from Florida. On the east coast the common shad (*Alosa sapidissima*) is a common and valued species. It occurs regularly and in considerable numbers in the St. Johns and St. Marys rivers and rarely in the Indian River. It is not positively known to occur in any other waters of the State.

At Pensacola, and doubtless elsewhere in the west-coast drainage, occurs the Alabama shad (*Alosa alabamæ*).

Shad have been reported from various west Florida rivers, particularly the Suwanee, Apalachicola, and Escambia rivers. It is not certainly known what species these may be, but it is more than likely that they are the Alabama shad. An actual examination of specimens from these rivers will be necessary to determine the matter, and the United States Fish Commission would be glad to receive specimens from anyone who has an opportunity to collect them.

SALT-WATER SPECIES.

The great majority of Florida fishes are, of course, salt-water species, there being not fewer than 495 species, distributed among many families and genera. On the east coast approximately 175 species are found, among the Florida Keys 290, and on the west coast about 300. Several important species are found throughout these three regions. Key West is the most important and interesting of all Florida localities as regards the number of species, about 250 species being known from there, of which about 100 are food-fishes of greater or less importance.

The richness of Key West in food-fishes will be seen when we recall the total number of food-fishes in each of the other important fishery regions of the United States, as shown in the following list:

South Atlantic States	55	Pacific States	40
Middle Atlantic States	50	Great Lakes	16
New England States	48	Gulf States (Florida excepted)	42

The more important species handled at Key West are the grunts (6 species), the porgies (5 species), the groupers (8 species), the snappers (4 species), the hog-fish, king-fish, Spanish mackerel, the carangoids (8 species), and the mullets (3 species). Besides these there are some 60 or 70 species which for one reason or another are less important but are nevertheless handled to some extent.

The method of handling fish at Key West is unique, and calculated to conserve the fisheries of that region to the fullest extent. Practically all of the fishing is done with hook and line, and every fishing boat has a well into which the fish are placed. All salable fish are brought to market in the wells of the vessels and kept alive until sold. The prospective purchaser visits the fish wharf, selects from some one of the boats the fish he desires, and it is then killed and dressed by the fisherman. This excellent method insures perfectly fresh fish to the purchaser, and few or no fish are lost or wasted.

There is no other place in the United States where one can study live fishes so satisfactorily as at Key West. Fishing boats are lying at the fish wharf at all times and in their wells may be seen specimens of numerous species, many of them of brilliant coloration; and by going out with the fishermen upon the bars and coral reefs one may, by the aid of a water glass, spend many hours observing and studying a multitude of fishes and other interesting forms as they disport themselves in the clear waters beneath the boat.

FOOD-FISHES OF FLORIDA.

While the waters in the vicinity of Key West are wonderfully rich in species of fishes used as food, the shad does not occur there, nor does the black bass nor any of the fresh-water species; nor do we find there, except possibly as stragglers, the spotted sea trout, the red drum, spot, whiting, pompon, flasher, and perhaps still other species known from Indian River. Additional species are known from Pensacola which do not occur at Key West. The total number of different species of food-fish now known to occur in the waters of Florida is approximately 140, divided among 36 different families, as follows:

Acipenseridæ (Sturgeon)	1
Siluridæ (Cat-fishes)	4
Catostomidæ (Suckers)	2
Cyprinidæ (Minnows)	1
Anguillidæ (Eels)	1
Elopidæ (Tarpons)	2
Albulidæ (Lady-fishes)	1
Clupeidæ (Herrings)	8
Luciidæ (Pikes)	2
Esocidæ (Needle-fishes)	2
Hemiramphidæ (Balaos)	4
Mugilidæ (Mullets)	4
Sphyrænidæ (Barracudas)	2
Polynemidæ (Threadfins)	1
Holocentridæ (Squirrel-fishes)	1
Scombridæ (Mackerels)	4
Trichiuridæ (Cutlas-fishes)	1
Carangidæ	14
Pomatomidæ (Blue-fish)	1
Centrarchidæ (Sun-fishes and Black Bass)	10
Centropomidæ (Robalos)	1
Serranidæ (Sea Bass)	10
Lobotidæ (Triple-tails)	1
Lutianidæ (Snappers)	8
Hæmulidæ (Grunts)	12
Sparidæ (Porgies)	12
Gerridæ (Mojarras)	4
Kyphosidæ (Rudder-fishes)	1
Sciænidæ (Croakers)	11
Labridæ (Wrasse-fishes)	1
Scaridæ (Parrot-fishes)	2
Ephippidæ (Angel-fishes)	1
Chætodontidæ (Butterfly-fishes)	3
Teuthiididæ (Tangs)	3
Scorpænidæ (Rock-fishes)	1
Pleuronectidæ (Flounders)	4

This large number represents about one-twentieth of the entire fish fauna of America north of the equator.

THE GAME-FISHES OF FLORIDA.

The fame of the game-fishes of the State of Florida extends throughout America, and beyond. Wherever there are anglers and rod and gun clubs, the prowess of the "silver king" is known and talked about. The one great hope of every angler is that he may go to Florida and kill a tarpon before his fishing days are over. But while the tarpon or silver king is the king of the game-fishes of this State, it is by no means the only game-fish. Some of the largest black bass known have been caught in Florida waters. The sunfishes are the largest of their kind. The lady-fish and bone-fish are thought by many to equal their relative, the tarpon, in real game qualities. Trolling for king-fish, jack, crevallé, blue-fish, Spanish mackerel, and spotted sea trout, at Indian River, Lake Worth, Key West, or Biscayne Bay, furnishes sport of the most exciting kind; while still-fishing for sheepshead and mangrove snappers at Indian River Inlet; for chubs, porgies, pork-fish, yellow-tails, snappers, and grunts at Key West; or for red snappers, red groupers, and others of their kin on the Snapper Banks, furnishes sufficient variety to please any angler, in whatever mood he may chance to be.

LIST OF SPECIES.

BRANCHIOSTOMATIDÆ. The Lancelets.

1. **Branchiostoma caribæum** Sundeval. *West Indian Lancelet.*

Snapper Banks, Gulf of Mexico, in 16 to 24 fathoms (*Grampus* coll., Kendall 1889, as *B. lanceolatum*); Tampa Bay (Andrews 1894, and *Fish Hawk* coll., 1898).

PETROMYZONIDÆ. The Lampreys.

2. **Petromyzon marinus** Linnæus. *Sea Lamprey.*

Not uncommon in the St. Johns River at Volusia Bar at the head of Lake George (Kendall coll., 1897).

GINGLYMOSTOMIDÆ. The Nurse Sharks.

3. **Ginglymostoma cirratum** (Gmelin). *Nurse Shark.*

West Florida (Velie coll., Goode & Bean 1879*a*); west coast of Florida (Velie coll., Goode & Bean 1879*b*); and Key West (Jordan 1884*a*).

GALEIDÆ. The Requiem Sharks.

4. **Mustelus canis** (Mitchill). *Dog Shark.*

Reported at Key West (Jordan 1884*a*) on authority of fishermen.

5. **Galeocerdo tigrinus** Müller & Henle. *Tiger Shark.*

St. Johns River (Goode 1879*a*), and Indian Key (Henshall 1889, as *G. maculatus*).

6. **Carcharinus milberti** (Müller & Henle).

Indian River (Goode 1879*a*, as *Eulamia milberti*).

7. **Carcharinus lamia** (Rafinesque). *Bay Shark.*

Key West and Florida Keys (Jordan 1884*a* and 1884*d*, as *Carcharias lamia*); Key Largo and Tortugas (Henshall 1889); Biscayne Bay (McCormick coll., Smith 1895).

8. **Carcharinus platyodon** (Poey).

Florida Keys and west coast (Henshall 1889), and Biscayne Bay (McCormick coll., Smith 1895).

9. **Carcharinus limbatus** (Müller & Henle).

San Carlos Pass (Henshall 1889, as *Eulamia limbata*).

10. **Hypoprion brevirostris** Poey.

West Florida (Goode & Bean 1879*a*); West coast (Velie coll., Goode & Bean 1879*b*); Key West (Jordan 1884*a*, as *Carcharias brevirostris*); Florida Keys (Jordan 1884*d*, as *C. brevirostris*); and Cape Sable Creek and Marco (Henshall 1889, as *Carcharinus brevirostris*).

11. **Scoliodon terræ-novæ** (Richardson). *Sharp-nose Shark.*

Pensacola (Jordan & Gilbert 1882, and Stearns coll., Bean 1883); Key West (Jordan 1884*a*, as *Carcharias punctatus*); Florida Keys (Jordan 1884*d*); Snapper Banks *Grampus* coll., Kendall 1889, as *Carcharinus terræ-novæ*); Cape Sable, Marco and Gasparillas (Henshall 1889, as *C. terræ-novæ*); Florida Keys (Lönnberg 1894, as *C. terræ-novæ*); Biscayne Bay (McCormick coll., Smith 1895, as *C. terræ-novæ*); and Indian River Inlet (Evermann & Bean 1896).

SPHYRNIDÆ. The Hammer-head Sharks.

12. **Sphyrna tiburo** (Linnæus). *Shovel-head Shark.*

West coast of Florida (Velie coll., Goode & Bean 1879*b*, as *Reniceps tiburo*); Pensacola (Jordan & Gilbert 1882, and Stearns coll., Bean 1883, as *R. tiburo*); Key West (Jordan 1884*a* and 1884*d*, and Henshall 1891); Charlotte Harbor (*Grampus* coll., Kendall 1889, as *R. tiburo*, and Henshall 1889); Florida (Lönnberg 1894); Biscayne Bay (McCormick coll., Smith 1895); and Indian River at Titusville (Evermann & Bean 1896).

13. Sphyrna zygæna (Linnæus). *Hammer-head Shark.*
Indian River (Goode 1879*a*); Cards Sound (Henshall 1889); Biscayne Bay (McCormick coll., Smith 1895); and Key West (Evermann & Kendall coll., 1896).

LAMNIDÆ. The Mackerel Sharks.

14. Isurus dekayi (Gill). *Mackerel Shark.*
Santa Rosa Island (Jordan & Gilbert 1882) and Florida (Jordan & Evermann 1896).

SQUALIDÆ. The Dog Sharks.

15. Squalus acanthias Linnæus. *Dog-fish.*
Indian River (Evermann & Bean 1896).

SQUATINIDÆ. The Angel Sharks.

16. Squatina squatina (Linnæus). *Angel Shark.*
Probably Florida (Le Sueur 1818, as *S. dumerili*) and Florida (Jordan & Evermann 1896).

PRISTIDÆ. The Saw-Fishes.

17. Pristis pectinatus Latham. *Saw-fish.*
Cedar Keys (Jordan coll., Jordan & Swain 1884*a*); Key West (Jordan 1884*a*); Big Gasparilla, west coast (Henshall 1889); Tampa (Henshall 1894); south Florida, Punta Gorda (Lönnberg 1894); Biscayne Bay (McCormick coll., Smith 1895); and Indian River at Stuart and Eau Gallie (Evermann & Bean 1896).

RHINOBATIDÆ. The Guitar-Fishes.

18. Rhinobatus lentiginosus Garman.
Coast of Florida (Garman 1880, type); Key West (Jordan 1884*a* and Lönnberg 1894); Egmont Key (Jordan 1884*a*); Key West and Tampa (Henshall 1894); and Punta Rassa (J. R. Moore coll., 1899).

RAJIDÆ. The Skates.

19. Raja ornata Garman.
Alligator Key (Garman 1881, type).

20. Raja eglanteria Bosc. *Briar Skate.*
Florida (Le Sueur 1824, as *Raia desmarestia*, type).

21. Raja lævis Mitchill. *Barndoor Skate.*
Stump Pass (Henshall 1889).

NARCOBATIDÆ. The Electric Rays.

22. Narcine brasiliensis (Ölfers). *Trembler.*
Florida (Garman 1881, as *N. brasiliensis corallina*, type); Key West (Jordan 1884*a*, as *N. corallina* and *N. umbrosa*, type; and Evermann & Kendall coll., 1896); Florida Keys (Jordan 1884*a*); and Key West and Pensacola (Jordan & Evermann 1886).

DASYATIDÆ. The Sting-Rays.

23. Urolophus jamaicensis (Cuvier). *Maid.*
Key West (Lönnberg 1894, as *U. torpedianus*).

24. Dasyatis centrura (Mitchill). *Common Northern Sting-ray.*
Sarasota Bay and Tampa (Henshall 1894).

25. Dasyatis hastata (De Kay). *Sting-ray.*
North to Florida (Jordan & Evermann 1896).

26. Dasyatis sabina (Le Sueur). *Common Southern Sting-ray.*
Florida (Le Sueur 1824, as *Trygon sabina*, type); St. Johns River (Goode 1879*a*, as *T. sabina*); Pensacola (Goode & Bean 1879*a*, as *T. sabina;* Stearns coll., Bean 1883); Gulf coast of Florida (Velie coll., Goode & Bean 1879*b*); Lake Monroe (Bean 1883, as *T. sabina*); Tampa and Sarasota bays (Henshall 1894); St. Johns River and lakes in

connection therewith, also Gulf Coast (Lönnberg 1894, as *T. sabina*); Indian River at Cocoa and Stuart and Indian River Inlet (Evermann & Bean 1896); Cape Florida, Anclote Sponge Kraals, and Tarpon Springs (Evermann & Kendall coll., 1896); St. Johns River at Satsuma, and Volusia Bar, Lake George (Kendall coll., 1897).

27. Dasyatis say (Le Sueur). *Southern Sting-ray.*

Key West (Jordan 1884*a*, as *Trygon sayi*); west coast (Henshall 1889, as *T. sayi*); Mullet Key, near Tampa Bay (Henshall 1894); Gulf Coast (Lönnberg 1894, as *T. sayi*); Biscayne Bay (McCormick coll., Smith 1895, as *T. sayi*); and Indian River at Stuart (Evermann & Bean 1896).

28. Pteroplatea maclura (Le Sueur). *Butterfly-ray.*

Indian River (Goode 1879*a*) and Sarasota Bay (Henshall 1894).

MYLIOBATIDÆ. The Eagle Rays.

29. Aetobatus narinari (Euphrasen). *Spotted Sting-ray.*

Key West (Bean 1883, as *Stoasodon narinari*); Lemon Bay (Henshall 1889, as *S. narinari*); Sarasota Bay (Henshall 1894, as *S. narinari*); and Biscayne Bay (McCormick coll., Smith 1895, as *S. narinari*).

30. Rhinoptera bonasus (Mitchill). *Cow-nose Ray.*

St. Johns River (Goode 1879*a*, as *R. quadriloba*); Pensacola (Stearns coll., Goode & Bean 1879*a*, as *R. quadriloba*); and Barnes Sound and Cape Sable (Henshall 1889, as *R. quadriloba*).

AODONTIDÆ. The Sea Devils.

31. Manta birostris (Walbaum). *Sea Devil; Devil-fish.*

Coasts of Florida (Goode 1879*a*, as *Ceratoptera birostris*); Pensacola (Stearns coll., Goode & Bean 1879*a*, as *C. birostris*); Punta Rassa (Jordan 1884*a*); Bocilla Pass, Punta Rassa, and Tampa Bay (Henshall 1889); and west coast (Lönnberg 1894).

ACIPENSERIDÆ. The Sturgeons.

32. Acipenser brevirostris Le Sueur. *Short-nose Sturgeon.*

St. Johns River (Goode 1879*a*, as *Acipenser* sp.); Key West (Jordan 1884*a*, as *Acipenser* sp.); and Indian River (Evermann & Bean 1896).

LEPISOSTEIDÆ. The Gar Pikes.

33. Lepisosteus osseus (Linnæus). *Long-nose Gar.*

St. Johns River (Goode 1879*a*; Bean 1880; and A. H. Curtis coll., Jordan 1880*a*); Estero Bay (Henshall 1889); and St. Johns River, Lake Jessup, and Lake Apopka (Lönnberg 1894).

34. Lepisosteus platostomus Rafinesque. *Short-nose Gar.*

Florida (De Kay 1842, as *L. platyrhincus*, and Bean 1883); St. Johns River (Goode 1879*a*); Pensacola (Stearns coll., Goode & Bean 1879*a*); Mill Creek (Woolman 1890); Little River (Smith coll., 1895); and Lake Butler, Tarpon Springs and Little River at Miami (Evermann & Kendall coll., 1896).

35. Lepisosteus tristœchus (Bloch & Schneider). *Alligator Gar.*

Lake John near Oakland, Orange County (Lönnberg 1894) and creeks flowing into Indian River and Lake Poinsett (Evermann & Bean 1896).

AMIIDÆ. The Bowfins.

36. Amia calva Linnæus. *Bowfin; "Grindle"; Mud-fish.*

Hillborough River near Tampa (Henshall 1889) and St. Johns River and lakes and Lake Apopka (Lönnberg 1894).

SILURIDÆ. The Cat-Fishes.

37. Felichthys marinus (Mitchill). *Sea Cat-fish; Gaff-topsail.*

St. Johns River (Goode 1879*a*, as *Ælurichthys marinus*); Key West (Jordan 1884*a*, as *Æ. marinus*; Henshall 1894, as *Æ. marinus*; and Evermann & Kendall coll., 1896); west coast (Henshall 1889, as *Ailurichthys marinus*); both coasts (Lönnberg 1894, as *A. marinus*); Biscayne Bay (McCormick coll., Smith 1895, as *A. marinus*); and Indian River (Evermann & Bean 1896).

38. **Galeichthys felis** (Linnæus). *Sea Cat-fish.*
West Florida at Bayport (Cope 1877, as *Arius equestris*); Florida coast (Goode 1879*a*, as *Ariopsis felis*); Marco Island (Velie coll., Goode & Bean 1879*b*, as *A. felis*); Florida (J. W. Milner coll., Bean 1883, as *Arius felis*); Key West (Jordan 1884*a*, and Evermann & Kendall coll., 1896); Florida Keys (Jordan 1884*d*, as *A. felis*); west coast (Henshall 1889, as *Tachysurus felis*); Tampa (Henshall 1894); Biscayne Bay (McCormick coll., Smith 1895, as *A. felis*); and Indian River at Stuart and elsewhere (Evermann & Bean 1896).

39. **Ictalurus punctatus** (Rafinesque). *Channel Cat; Spotted Cat.*
St. Johns River (Goode 1879*a*, as *Ichthælurus punctatus*, and Bean 1880, as *I. punctatus*); Lake Apopka (Lönnberg 1894, as *Ictalurus punctatus*); and St. Johns River near Welaka, Lake Monroe, and Palatka (Kendall coll., 1897).

40. **Ameiurus catus** (Linnæus). *Mud Cat.*
St. Johns River (Goode 1879*a* and Bean 1880, as *A. nigricans*); St. Johns River (Jordan & Meek 1884, as *Ictalurus niveiventris*); Lake Apopka (Lönnberg 1894, as *Ictalurus nigricans*); St. Johns River near Welaka and Palatka, and Lake Monroe (Kendall coll., 1897).

41. **Ameiurus okeechobeensis** (Heilprin). *Okeechobee Cat-fish.*
Lake Okeechobee (Heilprin 1887, as *Ictalurus okeechobeensis*, type).

42. **Ameiurus erebennus** Jordan.
St. Johns River (Jordan 1877, type); St. Johns and Arlington rivers (Goode 1879*a*); San Sebastian River (Henshall coll., Jordan 1880, and Evermann & Bean 1896); and St. Johns River, Orange County (Lönnberg 1894).

43. **Ameiurus natalis** (Le Sueur). *Yellow Cat.*
Pemberton and Sampson creeks, and Santa Fe, Withlacoochee, and Little Withlacoochee rivers (Woolman 1890); Fern Creek at Orlando, and ditches and pond around Kissimmee and near Lake Jessup (Lönnberg 1894, as *A. natalis*, var. *cupreus*).

44. **Ameiurus nebulosus** (Le Sueur). *Common Bullhead.*
Joshua Creek and Alligator Branch (Woolman 1890); Lake Apopka and other lakes (Lönnberg 1894); Little River near Miami and Miami River (Evermann & Kendall coll., 1896); and Lake Monroe, and Volusia Bar, Lake George (Kendall coll., 1897).

45. **Ameiurus nebulosus marmoratus** (Holbrook). *Marbled Bullhead.*
Florida (Jordan & Evermann 1896).

46. **Schilbeodes gyrinus** (Mitchill). *Poison Cat-fish.*
Santa Fe River and Sampson Creek (Woolman 1890, as *Noturus gyrinus*); Fern Creek near Orlando, and St. Johns River (Lönnberg 1894, as *N. gyrinus*); and Lake Monroe (Kendall coll., 1897).

47. **Schilbeodes leptacanthus** (Jordan).
New River at New River Station (Woolman 1890, as *Noturus leptacanthus*).

CATOSTOMIDÆ. The Suckers.

48. **Erimyzon sucetta** (Lacépède). *Chub Sucker.*
St. Johns River (Jordan 1878, as *E. goodei*, type); San Sebastian River (Henshall coll., Jordan 1880, as *E. goodei*); rivers and lakes of Florida, especially Lake Monroe (R. E. Earll coll., Bean 1883, as *E. goodei*); Escambia River (Bollman 1886); East Florida (Henshall coll., Jordan 1880, as *E. goodei*); Joshua Creek, Peace River at Zolfo Springs, Mill Creek, Little Withlacoochee River, Santa Fe River, Sampson Creek, and New River (Woolman 1890); Lake Apopka, Fern Creek, and small lakes between Apopka and Toronto (Lönnberg 1894); Little Arch Creek (Smith coll., 1895); ponds near Tampa (Evermann & Kendall coll., 1896); and Lake Monroe, ponds near Welaka, and St. Johns River at Welaka (Kendall coll., 1897).

49. **Minytrema melanops** (Rafinesque). *Spotted Sucker.*
Escambia River (Bollman 1886).

CYPRINIDÆ. The Minnows.

50. Opsopœodus osculus Evermann.

Lake Monroe, St. Johns River at Welaka, and Ocklawaha River (Kendall coll., 1897).

51. Opsopœodus bollmani Gilbert.

Alligator, Peace, and Little Withlacoochee rivers, Joshua Creek, and Alligator Branch (Woolman 1890).

52. Abramis crysoleucas bosci (Cuvier & Valenciennes). *Roach.*

Volusia (Cope 1877, as *Notemigonus ischanus*); Pensacola (Stearns coll., Goode & Bean 1879*a*, as *Notemigonus americanus*); St. Johns River (Bean 1880, as *N. americanus*); San Sebastian River (Henshall coll., Bean 1883, as *N. americanus*); Escambia River (Bollman 1886, as *N. chrysoleucus bosci*); Myakka and Hillsborough rivers (Henshall 1889, as *N. chrysoleucus*); Alligator River, Punta Gorda, Joshua and Charlie Apopka creeks, Alligator Branch, and Peace River at Wauchula and Bartow (Woolman 1890, as *N. chrysoleucus bosci*); Lakes Apopka and Jessup (Lönnberg 1894, as *N. chrysoleucus bosci*); Little Arch Creek (Smith coll., 1895); Lake Butler near Tarpon Springs and Little River near Miami (Evermann & Kendall coll., 1896); St. Johns River at Welaka and Georgetown, Lake Monroe, and swamp pool at Welaka (Kendall coll., 1897).

53. Notropis maculatus (Hay).

Lake Butler (Evermann & Kendall coll., 1896), and St. Johns River at Welaka and Lake Monroe (Kendall coll., 1897).

54. Notropis welaka Evermann & Kendall.

St. Johns River at Welaka, and Ocklawaha River (Evermann & Kendall 1897, type).

55. Notropis stigmaturus (Jordan).

Escambia River (Bollman 1886, as *N. venustus stigmaturus*).

56. Notropis roseus (Jordan).

Punta Gorda, Alligator River, Joshua, Charlie Apopka, and Oak creeks, Peace River at Zolfo Springs, Wauchula, and Bartow; Hillsborough River, Withlacoochee, Santa Fe, and Little Withlacooche rivers, (Woolman 1890); Okeefenokee Swamp (Jordan & Evermann 1896); Little Arch Creek and Little River (Smith coll., 1895); Miami, Little, and Anclote rivers (Evermann & Kendall coll., 1896); St. Johns River at Welaka, Volusia Bar at head of Lake George, Lake Monroe, Ocklawaha River, and Match Creek, a tributary of the Ocklawaha (Kendall coll., 1897).

57. Notropis xænocephalus (Jordan).

Escambia River (Bollman 1886).

58. Notropis metallicus Jordan & Meek.

Withlacoochee River (Woolman 1890); Clifton Springs near Lake Jessup (Lönnberg 1894); Suwanee basin to Escambia River (Jordan & Evermann 1896); Ocklawaha River and swamp, and Lake Monroe (Kendall coll., 1897).

59. Ericymba buccata Cope.

Escambia River (Bollman 1886).

ANGUILLIDÆ. The True Eels.

60. Anguilla chrysypa Rafinesque. *Common Eel.*

Pensacola (Stearns coll., Goode & Bean 1879*a*, as *A. vulgaris*); San Sebastian River (Henshall coll., Jordan 1880, as *A. rostrata*); Florida (J. W. Milner coll., Bean 1883, as *A. rostrata*); Key West (Jordan 1884*a*, as *A. rostrata*); St. Johns River (Lönnberg 1894); Indian River at Cocoa, Eau Gallie, and Titusville (Evermann & Bean 1896); Little River, near Miami (Evermann & Kendall coll., 1896); and Lake Monroe (Kendall coll., 1897).

SYNAPHOBRANCHIDÆ.

61. Synaphobranchus pinnatus (Gronow).

Lat. 28° 36′ 15″ N., long. 86° 50′ W., southward from Pensacola, in 347 fathoms (Goode & Bean 1896).

LEPTOCEPHALIDÆ. The Conger Eels.

62. Leptocephalus caudilimbatus (Poey).

Pensacola (Goode & Bean 1882, as *Conger caudicula*, type; Jordan & Gilbert 1882, as *C. caudicula;* Jordan & Gilbert 1883, as *L. caudicula*); Snapper Banks (Jordan 1884, as *C. caudicula*); and Snapper Banks off Pensacola (Jordan & Davis 1888).

63. Conger muræna macrura (Gilbert).

Pensacola (Jordan & Gilbert 1882, as *Ophichthys macrurus*).

MURÆNESOCIDÆ.

64. Hoplunnis diomedeanus Goode & Bean.

Lat. 28° 36′ N., long. 86° 50′ W., southward of Pensacola, in 111 fathoms (Goode & Bean 1896).

65. Neoconger mucronatus Girard.

Pensacola (Stearns coll., Goode & Bean 1879*a*) and west Florida (Jordan & Davis 1888).

66. Gordiichthys irretitus Jordan & Davis.

Snapper Banks off Pensacola (Jordan & Davis 1888, type).

MYRIDÆ. The Worm Eels.

67. Ahlia egmontis (Jordan).

Egmont Key (Jordan 1884*a* and 1884*e*, as type of *Myrophis egmontis;* Jordan & Davis 1888, and Jordan & Evermann 1896).

68. Myrophis punctatus Lütken. *Spotted Worm Eel.*

Pensacola Snapper Banks (Stearns coll., Jordan 1884, and Jordan & Davis 1888).

OPHICHTHYIDÆ. The Snake Eels.

69. Verma kendalli (Gilbert). *Worm Eel.*

Snapper Banks off Cape Romano, in 25 fathoms (*Grampus* coll., Gilbert in Kendall 1889, as *Sphagebranchus kendalli*, type; Jordan & Davis 1888, as *S. kendalli*, and Jordan & Evermann 1896 as type of *Verma*, new genus).

70. Letharchus velifer Goode & Bean.

West Florida (Goode & Bean 1882, type of genus and species, and Bean 1883); Snapper Banks (Jordan 1884, Kendall 1889, and Jordan & Evermann 1896); and Snapper Banks between Pensacola and Tampa (Jordan & Davis 1888).

71. Myrichthys acuminatus (Gronow).

Florida Keys (Jordan & Davis 1888, and Jordan & Evermann 1896).

72. Callechelys muræna Jordan & Evermann.

Snapper Banks (Stearns coll., Jordan & Evermann 1886, type; Jordan & Davis 1888, and Jordan & Evermann 1896).

73. Bascanichthys scuticaris (Goode & Bean).

Cedar Keys (Velie coll., Goode & Bean 1879*b*, as *Sphagebranchus scuticaris*, type); west Florida (Kaiser & Martin coll., Goode & Bean 1882, as *S. teres*, type; and Bean 1883, as *S. teres*); Egmont Key (Jordan 1884*e*, as *Cæcula scuticaris*); Egmont Key, Punta Rassa, and Pensacola (Jordan & Davis 1888); and off Key West, in about 100 fathoms (Garman 1896, as *S. scuticaris*).

74. Bascanichthys bascanium (Jordan).

Egmont Key (Jordan 1884*a*, as *Cæcula bascanium*, and 1884*e*, as type of *C. bascanium;* Jordan & Davis 1888, and Jordan & Evermann 1896).

75. Ophichthus retropinnis (Eigenmann).

Snapper Banks off Pensacola (Stearns coll., Eigenmann 1887, as type of *Ophichthys retropinnis;* Jordan & Davis 1888, and Jordan & Evermann 1896).

76. Ophichthus guttifer (Bean & Dresel).

Snapper Banks (Bean & Dresel 1882, as type of *Ophichthys guttifer;* Jordan & Davis 1888, and Jordan & Evermann 1896).

77. Ophichthus ocellatus (Le Sueur).

Snapper Banks near Pensacola (Stearns coll., Goode & Bean 1879*a*, as *Herpetoichthys ocellatus;* Jordan 1884; Jordan & Davis 1888; and Jordan & Evermann 1896).

78. Ophichthus gomesii (Castelnau).

Snapper Banks near Pensacola (Stearns coll., Jordan & Gilbert 1882*a*, as *O. chrysops;* Jordan 1884, as *O. chrysops*); and St. Augustine and Snapper Banks near Pensacola (Jordan & Davis 1888).

79. Mystriophis intertinctus (Richardson).

Pensacola (Stearns coll., Goode & Bean 1879*a*, as *Crotalopsis mordax*, and Jordan & Gilbert 1882, as *Ophichthys mordax*); Clearwater Harbor (Velie coll., Goode & Bean 1879*b*, as *C. mordax*, and Bean 1883, as *C. mordax*); Egmont Key (Jordan 1884*e*, as *O. intertinctus*); Snapper Banks (Stearns coll., Jordan 1884, as *O. schneideri*); Lemon Bay, Egmont Key, and Pensacola (Jordan & Davis 1888); Snapper Grounds in 20.5 fathoms (*Grampus* coll., Kendall 1889, as *O. punctifer*); Lemon Bay (Henshall 1889); and Ozona (Lönnberg 1894, as *O. punctifer*).

MURÆNIDÆ. The Morays.

80. Lycodontis moringa (Cuvier). *Common Spotted Moray.*

Key West (Jordan 1884*a*, as *Sidera moringa;* Henshall 1894, as *Gymnothorax moringa*; Lönnberg 1894, as *S. moringa;* and Evermann & Kendall coll., 1896); Florida Keys (Jordan 1884*d*, as *S. moringa*); Key West and Pensacola (Jordan & Davis 1888, as *G. moringa*); Key West and Key Largo (Henshall 1889, as *S. moringa*); Biscayne Bay (McCormick coll., Smith 1895, as *G. moringa*); Pensacola (Jordan & Evermann 1896).

81. Lycodontis funebris (Ranzani). *Black Moray.*

Key West (Jordan 1884*a*, as *Sidera funebris;* Jordan & Davis 1888, as *G. funebris;* Henshall 1894); Florida Keys (Jordan 1884*d*, as *S. funebris*, and Jordan & Evermann 1896); Tortugas, Key West and Marco (Henshall 1889, as *S. funebris*); Biscayne Bay (McCormick coll., Smith 1895).

82. Lycodontis ocellatus (Agassiz). *Spotted Moray.*

Pensacola (Stearns coll., Goode & Bean 1879*a*, as *Gymnothorax ocellatus;* Jordan & Gilbert 1882, as *Muræna ocellata;* and Jordan & Evermann 1896); Clearwater Harbor (Velie coll., Goode & Bean 1879*b*, as *G. ocellatus*); west Florida (Kaiser & Martin coll., Bean 1883, as *G. ocellatus*); Egmont Key (Jordan 1884*a* and 1884*e*, as *Sidera ocellata*); Santa Rosa Island (Jordan & Evermann 1886, as *S. nigromarginata*); Pensacola Snapper Banks and Cedar Keys (Jordan & Davis 1888, as *G. ocellatus*); and Snapper Banks (Jordan & Evermann 1896, as *L. ocellatus*, *L. ocellatus saxicola*, and *L. ocellatus nigromarginatus*).

ELOPIDÆ. The Tarpons.

83. Tarpon atlanticus (Cuvier & Valenciennes). *Tarpon.*

Garden Key (Girard 1859, as *Megalops elongatus*); St. Johns River (Jordan 1880*a*, as *Megalops thrissoides*); Key West (Jordan 1884*a*, as *M. atlanticus*); Florida Keys (Jordan 1884*d*, as *M. atlanticus*); Tampa Bay to Punta Rassa, and Little Sarasota Bay (Wilcox 1886, as *M. thrissoides*); Cards Sound and Punta Rassa (Henshall 1889, as *M. atlanticus*); Sarasota Bay, Charlotte Harbor and Caloosahatchee River (Henshall 1894, as *M. thrissoides*); Clearwater Harbor, Key West, Charlotte Harbor and New Smyrna (Lönnberg 1894); Biscayne Bay (McCormick coll., Smith 1895, as *M. thrissoides*); Indian River, Lake Worth, and Biscayne Bay (Evermann & Bean 1896); and Key West (Evermann & Kendall coll., 1897).

84. Elops saurus Linnæus. *Ten-pounder.*

Cape Cod to Florida (Holbrook 1860); St. Johns River (Bean 1880); Pensacola (Jordan & Gilbert 1882, and Bean 1883); Key West (Jordan 1884*a*); Florida Keys (Jordan 1884*d*); Tampa Bay to Punta Rassa, and Little Sarasota Bay (Wilcox 1886); Marco (Henshall 1889); Key West and Tampa (Henshall 1894); and St. Johns River at Welaka (Kendall coll., 1897).

ALBULIDÆ. The Lady-Fishes.

85. **Albula vulpes** (Linnæus). *Lady-fish; "Bone-fish."*
Pensacola (Stearns coll., Bean 1883); Key West (Jordan 1884*a*, and Jordan & Evermann 1896); Florida Keys (Jordan 1884*d*); Garden Key (*Grampus* coll., Kendall 1889); Key West, Pavilion Key, and San Carlos Pass (Henshall 1889); New Smyrna (Lönnberg 1894); Key West and Tampa (Henshall 1894); and Biscayne Bay (McCormick coll., Smith 1895).

DOROSOMATIDÆ. The Gizzard Shads.

86. **Dorosoma cepedianum** (Le Sueur). *Hickory Shad; Gizzard Shad; "Stink Shad."*
St. Johns River (Goode 1879*c*, and Bean 1880); Florida (Bean 1883); Escambia River (Bollman 1886); Lake Apopka, Lake Jessup, St. Johns River, and lakes Ivanhoe, Formosa, Rowena, etc., near Orlando (Lönnberg 1894); St. Johns River at Welaka, and in Lake Monroe (Kendall coll., 1897).

CLUPEIDÆ. The Herrings.

87. **Jenkinsia stolifera** (Jordan & Gilbert).
Key West (Jordan & Gilbert 1884*a*, *Dussumiera stolifera*, type; Jordan 1884*a*, as *D. stolifera*, and Jordan & Evermann 1896, as *Jenkinsia stolifera*, new genus); Cards Sound, Barnes Sound, and Florida Bay (Henshall 1889, as *D. stolifera*); Biscayne Bay (Smith coll., 1895); and Key West and Cape Florida (Evermann & Kendall coll., 1896).

88. **Etrumeus sadina** (Mitchill).
Pensacola (Jordan & Gilbert 1883, as *E. teres*).

89. **Clupanodon pseudohispanicus** (Poey). *Sardina de España.*
Pensacola (Jordan & Gilbert 1882, as *Clupea pseudohispanica*); Snapper Banks (Stearns coll., Jordan 1884, as *C. pseudohispanica*).

90. **Pomolobus chrysochloris** Rafinesque. *Skipjack.*
Pensacola (Stearns coll., Goode & Bean 1879*a*; Jordan & Gilbert 1882, as *Clupea chrysochloris;* and Bean 1883, as *C. chrysochloris*); and Escambia River (Bollman 1886, as *C. chrysochloris*).

91. **Pomolobus mediocris** (Mitchill). *Hickory Jack.*
St. Johns River (Goode 1879*a* and Bean 1880); Florida (Bean 1883, as *Clupea mediocris*, and Jordan & Evermann 1896); St. Johns River, Volusia Bar at head of Lake George, and Lake Monroe (Kendall coll., 1897).

92. **Pomolobus pseudoharengus** (Wilson). *Alewife.*
Florida (Bean 1883, as *Clupea vernalis*), and St. Johns River (Lönnberg 1894, as *Clupea pseudoharengus*).

93. **Pomolobus æstivalis** (Mitchill). *Glut Herring.*
St. Johns River (Goode 1879*a*), and St. Johns River, Welaka, Volusia Bar at Lake George, and Lake Monroe (Kendall coll., 1897).

94. **Alosa alabamæ** Jordan & Evermann. *Alabama Shad.*
Pensacola (Jordan & Gilbert 1882, as *Clupea sapidissima;* Evermann 1895, as *Alosa alabamæ*, cotypes; and Jordan & Evermann 1898).

95. **Alosa sapidissima** (Wilson). *Common Shad.*
St. Johns River and east coast (Goode 1879*a*); St. Johns River (Henshall 1894, and Kendall coll., 1897); Florida (Bean 1883, as *Clupea sapidissima*); St. Marys River (Hamlin 1884); Escambia River (Bollman 1886, as *C. sapidissima*); Indian River at Eden and St. Lucie River (Evermann & Bean 1896).

96. **Sardinella sardina** (Poey). *Sardina.*
Key West (Jordan 1884*a*, as *Clupea sardina;* Jordan & Evermann 1896; and Evermann & Kendall coll., 1896).

97. **Sardinella macrophthalma** (Ranzani).
Key West and Florida Keys (Henshall 1889, as *Harengula macrophthalma*).

98. Sardinella humeralis (Cuvier & Valenciennes). *White-bill.*

Pensacola (Stearns coll., Goode & Bean 1879*a*, as *Harengula pensacolæ*, type; Stearns coll., Bean 1883, as *H. pensacolæ*); Clearwater Harbor (Velie coll., Goode & Bean 1879*b*, as *H. pensacolæ*); Garden Key (Whitehurst coll., Bean 1883); Key West (Jordan 1884*a*, as *Clupea pensacolæ*); Florida Keys (Jordan 1884*d*, as *C. pensacolæ*); Florida Keys, west coast, Cape Sable Creek, San Carlos Pass, Marco, Big Gasparilla and Egmont Key (Henshall 1889, as *H. arcuata*); St. Petersburg (Lönnberg 1894, as *H. pensacolæ*); Cedar Keys and Pensacola (Jordan & Evermann 1896); and Key West and Miami (Evermann & Kendall coll., 1896).

99. Opisthonema oglinum (Le Sueur). *Thread Herring.*

Pensacola (Stearns coll., Goode & Bean 1879*a*, as *O. thrissa;* and Jordan & Gilbert 1882, as *O. thrissa*); Egmont Key (Jordan 1884*e*); Big Gasparilla, Egmont Key, and west coast (Henshall 1889); Pelican Island, Indian River (Evermann & Bean 1896); and Key West (Evermann & Kendall coll., 1896).

100. Brevoortia tyrannus (Latrobe). *Menhaden.*

St. Johns and Indian rivers (Goode 1878; Bean 1880; and A. N. Curtis coll., Jordan 1880*a*); St. Johns River and coast (Goode 1879*a*); Florida (Milner coll., Bean 1883); Tampa and St. Johns River (Henshall 1894); New Smyrna (Lönnberg 1894); and Indian River (Evermann & Bean 1896).

101. Brevoortia tyrannus patronus Goode. *Gulf Menhaden.*

Pensacola (Stearns 1878, as *B. patronus;* Goode & Bean 1879*a*, as *B. patronus;* Bean 1880, as *B. patronus;* and Jordan & Gilbert 1882, as *B. patronus*); west Florida (Goode & Bean 1879*a*, as *B. patronus*).

ENGRAULIDIDÆ. The Anchovies.

102. Stolephorus miarchus Jordan & Gilbert. *Anchovy.*

Key West (Jordan 1884*a*).

103. Stolephorus perfasciatus (Poey). *Grubber Broadhead.*

Key West (Jordan 1884*a*); Marco (Henshall 1889); and Florida Keys (Jordan & Evermann 1896).

104. Stolephorus perthecatus Goode & Bean.

Pensacola (Stearns coll., Goode & Bean 1882, type).

105. Stolephorus brownii (Gmelin). *Striped Anchovy.*

Clearwater Harbor (Velie coll., Goode & Bean 1879*b*, as *Engraulis hiulcus*, type, and Swain 1882*a*); Cedar Keys (Jordan & Swain 1884*a*); Key West (Jordan 1884*a*, and Lönnberg 1894); Florida Keys (Jordan 1884*d*); Cape Sable Creek, Cape Romano, and Big Gasparilla (Henshall 1889); mouth of Little River, and Cape Florida (Smith coll., 1895); and Key West and Cape Florida (Evermann & Kendall coll., 1896).

106. Stolephorus mitchilli (Cuvier & Valenciennes).

Pensacola (Jordan & Gilbert 1882, and Swain 1882*a*); Cards Sound, Barnes Sound, Key West, Marco, Gordon Pass and Big Estero Pass (Henshall 1889); St. Petersburg (Lönnberg 1894); Little River (Smith coll., 1895); and Indian River at Cocoa and St. Lucie River (Evermann & Bean 1896).

ALEPOCEPHALIDÆ.

107. Talismania antillarum Goode & Bean.

South of Pensacola, lat. 28° 38′ 30″ N., long. 87° 02′ W., in 420 fathoms (Goode & Bean 1896, as *Bathytractes* (*Talismania*, new genus) *antillarum*, type).

108. Conocara macdonaldi Goode & Bean.

West of Tortugas (Goode & Bean 1896, new genus and species).

SYNODONTIDÆ. The Lizard-Fishes.

109. Trachinocephalus myops (Forster). *Ground Spearing.*

Florida Keys and Garden Key (Whitehurst coll., Bean 1883).

110. Synodus intermedius (Agassiz).

Pensacola (Jordan & Gilbert 1882); Key West (Jordan 1884*a*, as *S. cubanus;* Meek 1884, as *S. analis;* and Evermann & Kendall coll., 1896); Snapper Banks (Jordan 1884, as *S. cubanus*); Florida Keys (Jordan 1884*d*, as *S. cubanus*); Snapper Banks (Jordan & Gilbert 1883); off Key West in about 60 fathoms (Garman 1896); and Key West (Evermann & Kendall coll., 1896).

111. Synodus fœtens (Linnæus). *Lizard-fish.*

Long Island to Gulf of Mexico (Holbrook 1860, as *Saurus fœtens*); Key West (Goode & Bean 1879*b;* Jordan 1884*a*, as *S. fœtens* and *S. spixianus;* and Lönnberg 1894); Cedar Keys (Jordan & Swain 1884*a*); Key West and Cedar Keys (Meek 1884, as *S. spixianus*); Snapper Banks in 37 fathoms (*Grampus* coll., Kendall 1889); Key West, Gordon Pass, San Carlos Pass, and Big Gasparilla (Henshall 1889); Key West and Tampa (Henshall 1894); Lake Worth (Smith coll., 1895); and Key West and Anclote Sponge Kraals (Evermann & Kendall coll., 1896).

BENTHOSAURIDÆ.

112. Benthosaurus grallator Goode & Bean.

West of Tortugas (Goode & Bean 1886, type of genus and species, and 1896).

BATHYPTEROIDÆ.

113. Bathypterois longipes Günther.

Lat. 25° 83′ N., long. 84° 35′ W., in 539 fathoms, northwest of Tortugas (Goode & Bean 1896).

IPNOPIDÆ.

114. Ipnops murrayi Günther.

Lat. 24° 36′ N., long. 84° 05′ W., in 955 fathoms, westward of Tortugas (Goode & Bean 1896.)

MYCTOPHIDÆ. The Lantern-Fishes.

115. Lampanyctus lacerta Goode & Bean.

South of Cape San Blas, lat. 28° 38′ 30″ N., long. 85° 52′ 30″ W., in 142 fathoms (Goode & Bean 1896, type).

CHAULIODONTIDÆ. The Viper-Fishes.

116. Chauliodus sloanei Bloch & Schneider.

Lat. 28° 47′ 30″ N., long. 87° 27′ W., in 724 fathoms, and lat. 28° 43′ N., long. 87° 14′ 30″ W., in 525 fathoms, southward from Pensacola (Goode & Bean 1896).

STOMIATIDÆ.

117. Stomias affinis Günther.

Off Sombrero Key (Günther 1887).

118. Echiostoma margarita Goode & Bean.

Lat. 28° 38′ 30″ N., long. 87° 02′ W., in 420 fathoms, southward of Pensacola (*Albatross* coll., Goode & Bean 1896, type).

PARALEPIDIDÆ.

119. Paralepis coregonoides Risso.

Lat. 28° 43′ N., long. 87° 14′ 30″ W., in 523 fathoms, southward of Pensacola (*Albatross* coll., Goode & Bean 1896).

HALOSAURIDÆ.

120. Halosauropsis gracilis (Goode & Bean).

South of Pensacola (*Albatross* coll., Goode & Bean 1896, type of genus and species).

121. Halosauropsis pallidus (Goode & Bean).

Lat. 24° 36′ N., long. 84° 05′ W., in 955 fathoms, about west from Tortugas (*Albatross* coll., Goode & Bean 1896).

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LUCIIDÆ. The Pikes and Pickerels.

122. Lucius americanus (Gmelin). *Banded Pickerel.*

East Florida (Holbrook 1860, as *Esox ravenelii*, type); Elbow Creek, tributary of Indian River (Bean 1883, as *E. americanus*); Escambia River (Bollman 1886, as *Esox americanus*, in part; and as *Esox reticulatus*, Jordan & Evermann 1896); ponds near Welaka (Kendall coll., 1897).

123. Lucius reticulatus (Le Sueur). *Common Eastern Pickerel; Jack.*

Between Tokoi and St. Augustine (Say, in Le Sueur 1818, type of *Esox phaleratus;* Goode 1879*a*, as *Esox phaleratus*); Escambia River (Bollman 1886, as *Esox reticulatus*, in part; Crooked Lake near Oakland, Orange County (Lönnberg 1894, as *E. reticulatus*); and Ocklawaha River and Lake Monroe (Kendall coll., 1897).

PŒCILIIDÆ. The Killi-Fishes.

124. Fundulus similis (Baird & Girard). *Sac-a-lait.*

Pensacola (Goode & Bean 1879*a*, as *Hydrargyra similis*; Jordan & Gilbert 1882; and Jordan & Stearns coll., Bean 1883); Cedar Keys (Jordan & Swain 1884*a*); Key West (Jordan 1884*a*, and Evermann & Kendall coll., 1896); Barnes Sound, Cape Romano, Marco, Big Gasparilla, Gordon Pass, Myakka River, Stump Pass, Lemon Bay, and Sarasota Bay (Henshall 1889); Key West, Hillsborough County, Clearwater Harbor, and Hog Island (Lönnberg 1894); mouth Little River, and Lake Worth (Smith coll., 1895); Pelican Island, Indian River (Evermann & Bean 1896); and Tampa Bay (*Fish Hawk* coll., 1898).

125. Fundulus majalis (Walbaum). *Killi-fish.*

Mouth of St. Johns River (Goode 1879*a*, as *Hydrargyra majalis*), and Indian River (Würdemann coll., Bean 1883).

126. Fundulus grandis (Baird & Girard). *Common Killi-fish.*

Charlotte Bay (Girard 1859, as *F. floridensis*, type; and Goode 1879*a*, as *F. floridensis*); Pensacola (Goode & Bean 1879*a;* Jordan & Gilbert 1882; and Jordan & Stearns coll., Bean 1883); Key West (Jordan & Swain 1884; Jordan 1884*a*, as *F. heteroclitus;* and Evermann & Kendall coll., 1896); Gordon Pass, Barnes Sound, Myakka River, and Stump Pass (Henshall 1889, as *F. heteroclitus*); New Smyrna, in ditches from Hillsboro River, Key West, and Punta Gorda (Lönnberg 1894, as *F. heteroclitus*); Lake Worth (Smith coll., 1895); Indian River Inlet, Titusville, Cocoa, and Pelican Island (Evermann & Bean 1896); Gulf Coast (Jordan & Evermann 1896); and Tampa Bay (*Fish Hawk* coll., 1898).

127. Fundulus seminolis Girard.

Palatka (Glover coll., Girard 1859, type); Lake Monroe (Goode 1879*a*; and Baird coll., Bean 1883); Joshua, Oak, and Charlie Apopka creeks, Alligator Branch, and Peace River at Wauchula (Woolman 1890); sulphur springs (Clifton Springs) at Lake Jessup (Lönnberg 1894); St. Johns River at Palatka and Welaka, swamp at Welaka, St. Johns River at Fort Gates and Georgetown, Volusia Bar at head of Lake George, and Lake Monroe (Kendall coll., 1897).

128. Fundulus confluentus Goode & Bean.

Lake Monroe (Baird coll., Goode & Bean in Goode 1879*a*, type); Pensacola (Jordan & Gilbert 1882, as *F. ocellaris*, type; Bean 1883, as *F. ocellaris;* and Jordan & Evermann 1896); Cards Sound (Henshall 1889, as *F. ocellaris*); Withlacoochee River (Woolman 1890, as *F. ocellaris*); St. Johns River at Sanford (Lönnberg 1894, as *F. ocellaris*); and Lake Monroe (Jordan & Evermann 1896, as *F. ocellaris*).

129. Fundulus goodei (Jordan).

Arlington River (Jordan 1879, as *Lucania goodei*, type); streams of east Florida (Goode coll., Bean 1883, as *L. goodei*); Alligator River, Peace River at Wauchula, and Withlacoochee River (Woolman 1890, as *L. goodei*); Fern Creek at Orlando, St. Johns

River and other waters in Orange, Kissimmee and Osceola counties (Lönnberg 1894, as *L. goodei*); Hillsboro and Little rivers (Smith coll., 1895); Little River, Miami River, Lake Butler and Anclote River at Pindar's Landing (Evermann & Kendall coll., 1896); Match Creek, Ocklawaha River, St. Johns River at Palatka, Welaka, swamp at Welaka, sulphur springs at Welaka, and Lake Monroe (Kendall coll., 1897).

130. Fundulus chrysotus Holbrook.

Arlington River (Goode & Bean in Goode 1879*a*, as *Gambusia arlingtonia*, type); St. Augustine and Arlington (Goode 1879*a*, as *Zygonectes chrysotus*); Arlington River (Jordan 1879, as *Z.* (*Gambusia*) *arlingtonensis*); San Sebastian River (Henshall coll., Jordan 1879, as *Z. henshalli*, type, and Jordan 1880, as *Z. henshalli;* and Jordan & Evermann 1896); streams of East Florida, San Sebastian River, Elbow Creek (Bean 1883, as *Z. henshalli*); Myakka River and fresh ponds near it, and Gordon Pass (Henshall 1889, as *Z. chrysotus* and *Z. henshalli*); Joshua Creek, Peace River at Zolfo, Wauchula, and Bartow, Alligator Branch, Santa Fe River, Sampson Creek, Withlacoochee and Little Withlacoochee rivers and New River (Woolman 1890, as *Z. chrysotus*); ditches and ponds at Arcadia and at Toronto (Lönnberg 1894, as *Z. chrysotus*); Fern Creek, Ivanhoe and Formosa lakes and other waters in Orange County (Lönnberg 1894, as *Z. henshalli*); Indian River (Evermann & Bean 1896, as *Z. chrysotus* and *Z. henshalli*); ponds near Tampa, Lake Butler and Miami River (Evermann & Kendall coll., 1896), and Ocklawaha River, ponds near Welaka and Lake Monroe (Kendall coll., 1897).

131. Fundulus cingulatus Cuvier & Valenciennes.

San Sebastian River (Henshall coll., Jordan 1879, as *Zygonectes rubrifrons*, type, and Jordan 1880 as *Z. rubrifrons*, and Evermann & Bean 1896); Westville (Mann & Davison coll., Hay 1885, as *Z. auroguttatus*, type); Escambia River (Bollman 1886); and Lake Monroe and ponds near Welaka (Kendall coll., 1897).

132. Fundulus nottii (Agassiz).

Elbow Creek, a tributary of Indian River, eastern Florida (Henshall coll., Goode & Bean 1882, type of *Zygonectes craticula*); tributaries of Indian River (Bean 1883); Santa Fe River, Sampson Creek and New River (Woolman 1890, as *Z. notti*); creeks between Lake Ivanhoe and Lake Formosa and in the lakes themselves (Lönnberg 1894, as *Z. craticula*); Elbow Creek near Eau Gallie (Evermann & Bean 1896); Elbow Creek, tributary of Indian River (Jordan & Evermann 1896); and ponds near Welaka (Kendall coll., 1897).

133. Fundulus guttatus (Agassiz).

Escambia River at Flomaton, Ala. (Bollman 1886, type of *Zygonectes escambiæ*).

134. Adinia multifasciata Girard.

Pensacola (Jordan & Gilbert 1882, type of *Fundulus xenicus;* Bean 1883, as *F. xenicus*, and Jordan & Evermann 1896); Charlotte Harbor (*Fish Hawk* coll., 1889).

135. Lucania ommata (Jordan).

Indian River near Titusville (R. E. Earll coll., Jordan 1884*c*, type of *Heterandria ommata;* Evermann & Bean 1896); Yellow Water River (N. T. Mann coll., Hay 1885, type of *Zygonectes manni*); and Santa Fe River, Sampson Creek and New River (Woolman 1890).

136. Lucania venusta (Girard).

Pensacola (Jordan & Gilbert 1882, and Stearns coll., Bean 1883); Indian River Inlet, Titusville, Cocoa, Pelican Island and South Lake (Evermann & Bean 1896); and Tarpon Springs (Evermann & Kendall coll., 1896).

137. Lucania parva (Baird & Girard). *Rainwater-fish.*

Key West (Jordan 1884*a*, and Jordan & Evermann 1896); Cards Sound, Gordon Pass, Big Gasparilla, Myakka River and Long Boat Key (Henshall 1889); Lake Worth (Smith coll., 1895); Salt Lake near Lake Butler, Anclote Sponge Kraals and Oyster Creek near Tarpon Springs (Evermann & Kendall coll., 1896); and at Palatka, Satsuma and Welaka in St. Johns River (Kendall coll., 1897).

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138. Cyprinodon variegatus Lacépède. *Sheepshead Minnow.*

East Florida (McClure, Ord & Say coll., Le Sueur 1821, type of *Lebias ellipsoidea*); Pensacola (Stearns coll., Goode & Bean 1879*a*; Jordan & Gilbert 1882; and as *C. gibbosus*, Bean 1883); St. Augustine and Lake Monroe (Goode 1879*a*); Jupiter Inlet (Henshall coll., Bean 1883); Boca Grande (*Fish Hawk* coll., 1889); Barnes Sound, Big Gasparilla, Myakka River, pond near Stump Pass, and Long Boat Key (Henshall 1889); Key West, Punta Gorda, Hog Island, Ozona and New Smyrna (Lönnberg 1894); Lake Worth (Smith coll., 1895); and Indian River at Titusville, Stuart, Pelican Island, Indian River Inlet, Cocoa and South Lake (Evermann & Bean 1896).

139. Cyprinodon variegatus riverendi (Poey).

Key West (Jordan 1884*a*, and Jordan & Evermann 1896), and Tampa Bay (*Fish Hawk* coll., 1898).

140. Cyprinodon carpio Günther.

Pensacola (Stearns coll., Goode & Bean 1882, type of *C. mydrus;* and Bean 1883, as *C. mydrus*); Key West (Jordan 1884*a*, as *C. mydrus*); Cards Sound, Key West, Lemon Bay, Barnes Sound, Marco, Gordon Pass, San Carlos Pass, Big Gasparilla, Long Boat Key and Sarasota Bay (Henshall 1889); Key West and Punta Gorda (Lönnberg 1894); Little River (Smith coll., 1895); Cape Florida, Key West and Tarpon Springs (Evermann & Kendall coll., 1896); and Tampa Bay (*Fish Hawk* coll., 1898).

141. Jordanella floridæ Goode & Bean.

Lake Monroe (Baird coll., Goode 1879*a*, type of genus and species); San Sebastian River (Henshall coll., Jordan 1879 and 1880); Jupiter Inlet and Lake Monroe (Bean 1883); Indian River (R. E. Earll coll., Jordan 1884*c*); fresh pond near Myakka River (Henshall 1889); Alligator River, Punta Gorda, Joshua Creek, Peace River at Zolfo, Alligator Branch, Pemberton Creek, Withlacoochee River, Little Withlacoochee River, and Pond Creek (Woolman 1890); St. Johns River and tributaries, Lake Jessup, Lake Tohopekaliga and other waters (Lönnberg 1894); Hillsboro River (Smith coll., 1895); Sebastian and Indian rivers (Evermann & Bean 1896); Miami and Little rivers (Evermann & Kendall coll., 1896); and swamps near Welaka and Lake Monroe (Kendall coll., 1897).

142. Gambusia affinis (Baird & Girard). *Top Minnow.*

Palatka (T. Glover coll., Girard 1859, type of *G. holbrooki*); Volusia (Cope 1877, as *Haplochilus melanops*); San Sebastian River (Henshall coll., Jordan 1880, as *G. patruelis*); St. Johns River (Jordan & Meek 1884, as *G. patruelis*); Myakka River and pond near it (Henshall 1889); Alligator River, Punta Gorda, Charlie Apopka and Oak creeks, Peace River at Zolfo Springs, Wauchula and Bartow, Alligator Branch, Pemberton Creek, Galliger Drain, Mill Creek, Withlacoochee and Little Withlacoochee rivers, Pond Creek, Santa Fe River, Sampson Creek and New River (Woolman 1890); Orange County, Kissimmee, Arcadia, Lake Jessup and Lake Beauty near Orlando (Lönnberg 1894); Little Arch Creek, Crocodile Hole, Indian Creek and Hillsboro River (Smith coll., 1895); Palm Beach (Evermann & Bean 1896); ponds near Tampa, Miami River and Lake Butler (Evermann & Kendall coll., 1896); Ocklawaha River, Palatka, St. Johns River, ponds and sulphur springs near Welaka, Volusia Bar and Lake Monroe (Kendall coll., 1897).

143. Heterandria formosa Agassiz. *Least-fish.*

Palatka (Girard 1859, and Kendall coll., 1897); Florida (Glover coll., Goode 1879*a*, as *Girardinus formosus*); Arlington River (Jordan 1879, as *G. formosus*); St. Johns River (Goode coll., Bean 1883, as *G. formosus*); St. Johns River (Jordan & Meek 1884); Myakka River and fresh pond near it (Henshall 1889); Fern Creek, ponds near Orlando, ditches near Oviedo, small lake at McDonald near Zellwood, St. Johns River, Lake Jessup and Lake Kissimmee (Lönnberg 1894, as *G. formosus*); Hillsboro River (Smith coll., 1895); Lake Butler and Little River at Miami (Evermann & Kendall coll., 1896); Match Creek, tributary of Ocklawaha River, St. Johns River at Welaka, Palatka, Volusia Bar at head of Lake George, Lake Monroe and swamp pools and sulphur springs near Welaka (Kendall coll., 1897).

144. Mollienisia latipinna Le Sueur.

East Florida (McClure, Ord and Say coll., Le Sueur 1821, as *Mollienisia multilineata*, new genus and species); Pensacola (Stearns coll., Goode & Bean 1879*a*; and Jordan & Gilbert 1882, as *M. latipinna*); St. Augustine (Goode 1879*a*); Clearwater Harbor (Velie coll., Goode & Bean 1879*b*); St. Johns River (Curtis coll., Jordan 1880*a*; Jordan & Meek 1884); Lake Monroe (Baird coll., Bean 1883; and Kendall coll., 1897); Jupiter Inlet (Henshall coll., Bean 1883); Cards Sound, Barnes Sound, Gordon Pass, Stump Pass, Lemon Bay and Big Gasparilla (Henshall 1889); Punta Gorda (*Fish Hawk* coll., 1889); Peace River at Zolfo Springs, Alligator Branch, Charlie Apopka and Oak creeks, Withlacoochee and Little Withlacoochee rivers, and Pond Creek (Woolman 1890); Lake Worth, Little Arch Creek and Hillsboro and Little rivers (Smith coll., 1895); Titusville and Indian River Inlet (Evermann & Bean 1896); Little River near Miami (Evermann & Kendall coll., 1896); Palatka, swamp at Welaka, Ocklawaha River, Volusia Bar at head of Lake George, and Lake Monroe (Kendall coll., 1897); and Tampa Bay (*Fish Hawk* coll., 1898).

ESOCIDÆ. The Needle-Fishes.

145. Tylosurus notatus (Poey). *Needle-fish.*

Pensacola (Kaiser & Martin coll., Goode & Bean 1879*a*, as *Belone notata*); Charlotte Harbor (Henshall coll., Bean 1883); Key West (Jordan 1884*a* and 1884*d*; and Jordan & Evermann 1896); Pensacola and Key West (Jordan & Fordice 1886); Cards Sound, Black Island, west coast, and Charlotte Harbor (Henshall 1889); Key West and Tampa (Henshall 1894); Key West and Punta Gorda (Lönnberg 1894); Biscayne Bay (McCormick coll., Smith 1895); Titusville (Evermann & Bean 1896); Key West, Tarpon Springs, Anclote Sponge Kraals, and Miami (Evermann & Kendall coll., 1896); and Tampa Bay (*Fish Hawk* coll., 1898).

146. Tylosurus timucu (Walbaum).

Key West (Jordan & Gilbert 1884*a*, as *T. sagitta*, type; Jordan 1884*a*, as *T. sagitta;* and Jordan & Fordice 1886, as *T. subtruncatus*).

147. Tylosurus marinus (Walbaum). *Bill-fish; Agujon.*

Pensacola (Stearns coll., Goode & Bean 1879*a*, as *Belone longirostris*); St. Johns River (Goode 1879*a*, as *B. longirostris*); Pensacola (Jordan & Gilbert 1882, as *T. longirostris*); Charlotte Harbor (Milner coll., Bean 1883); Cedar Keys (Jordan & Swain 1884*a*); Gadsden Point and Lacosta Island (*Grampus* coll., Kendall 1889); Cards Sound, Lemon Bay and west coast (Henshall 1889); Key West, Ozona and Lake Jessup (Lönnberg 1894); Indian River Inlet and Pelican Island (Evermann & Bean 1896); Key West, Tarpon Springs and Miami River (Evermann & Kendall coll., 1896); and St. Johns River (Kendall coll., 1897).

148. Tylosurus raphidoma (Ranzani). *Hound-fish.*

Pensacola (Stearns coll., Goode & Bean 1882, as *T. gladius*, type); Florida Keys (Jordan 1884*d*, as *T. crassus*); Key West (Jordan 1884*a*, as *T. crassus*; and Henshall 1894); Key West and Pensacola (Jordan & Fordice 1886); Florida Keys (Henshall 1889, as *T. crassus;* and Lönnberg 1894, as *T. crassus*); Biscayne Bay (McCormick coll., Smith 1895); and Florida Keys and Pensacola (Jordan & Evermann 1896).

149. Athlennes hians (Cuvier & Valenciennes).

East Florida (Goode 1879*a*, as *Belone hians;* and Jordan & Fordice 1886, as *Tylosurus* (*Athlennes,* new subgenus) *hians*).

HEMIRAMPHIDÆ. The Balaos.

150. Chriodorus atherinoides Goode & Bean. *Hardhead.*

Key West (Stearns coll., Goode & Bean 1882, as *C. atherinoides*, type of genus and species; Jordan 1884*a* and 1884*d*; Lönnberg 1894; Jordan & Evermann 1896; and Evermann & Kendall coll., 1896).

151. Hyporhamphus unifasciatus (Ranzani). *Halfbeak; Balaó; Needle-fish.*
Cedar Keys (Jordan & Swain 1884*a*, as *Hemirhamphus unifasciatus*); Indian River (Henshall coll., Jordan 1880, as *H. unifasciatus*); St. Johns River (A. H. Curtis coll., Jordan 1880*a*, as *H. unifasciatus*); Florida (Stearns coll., Bean 1883, as *H. unifasciatus*); Florida Keys (Jordan 1884*d*, as *H. unifasciatus*); Gadsden Point (*Grampus* coll., Kendall 1889, as *H. unifasciatus*); Florida Keys and Tortugas (Henshall 1889, as *H. unifasciatus*); Clearwater Harbor and Key West (Lönnberg 1894, as *H. unifasciatus*); Biscayne Bay (McCormick coll., Smith 1895, as *H. unifasciatus*); east Florida (Smith coll., 1895); Key West (Jordan & Evermann 1896); and Anclote Sponge Kraals and Tarpon Springs (Evermann & Kendall coll., 1896).

152. Hyporhamphus roberti (Cuvier & Valenciennes). *Common Halfbeak; Balaó.*
Cape Sable and west coast (Henshall 1889, as *Hemirhamphus roberti*); Biscayne Bay (McCormick coll., Smith 1895); Pensacola and Cedar Keys (Jordan & Evermann 1896); Tarpon Springs and Anclote Sponge Kraals (Evermann & Kendall coll., 1896).

153. Hemirhamphus brasiliensis (Linnæus). *Balaó.*
Key West (Jordan 1884*a*, as *H. balao;* Jordan 1884*f*, as *H. pleei;* Lönnberg 1894; and Jordan & Evermann 1896).

154. Hemirhamphus balao Le Sueur. *Balaó.*
Florida Keys (Jordan 1884*d*, and Henshall 1889); Key West (Henshall 1894); and Florida Reefs (Garman 1896).

155. Euleptorhamphus velox Poey.
New Smyrna (Lönnberg 1894, as *Hemirhamphus longirostris*).

SCOMBERESOCIDÆ. The Sauries.

156. Scomberesox saurus (Walbaum). *Needle-fish.*
Biscayne Bay (McCormick coll., Smith 1895).

EXOCŒTIDÆ. The Flying-Fishes.

157. Parexocœtes mesogaster (Bloch). *Flying-fish.*
Pensacola (Stearns coll., Jordan & Gilbert 1882, as *Exocœtus hillianus*, and Jordan & Gilbert, 1883, as *Exocœtus mesogaster;* Bean 1883, and Jordan 1884); and Snapper Banks (Stearns coll., Jordan 1884).

158. Exonautes exsiliens (P. L. S. Müller). *Flying-fish.*
Gulf coast of Florida (*Grampus* coll., Henshall 1889, as *Exocœtus exsiliens*).

159. Exonautes rondeletii (Cuvier & Valenciennes). *Flying-fish.*
Pensacola (Stearns coll., Jordan 1884, type of *Exocœtus volador*), and Snapper Banks (Stearns coll., Jordan 1884).

160. Cypselurus heterurus (Rafinesque). *Flying-fish.*
Snapper Banks (Stearns coll., Jordan 1884, as *Exocœtus noveboracensis*, and *Grampus* coll., Kendall 1889, as *E. noveboracensis*).

AULOSTOMIDÆ. The Trumpet-Fishes.

161. Aulostomus maculatus Valenciennes. *Trompetero.*
Tortugas (Jefferson, Porter & Moore 1878, as *A. coloratum*), and Florida Keys (Jordan 1884*a*, as *A. maculatum*).

FISTULARIIDÆ. The Cornet-Fishes.

162. Fistularia tabacaria Linnæus. *Trumpet-fish.*
Florida (Jordan & Evermann 1896).

SYNGNATHIDÆ. The Pipe-Fishes.

163. Siphostoma mackayi Swain & Meek. *Pipe-fish.*
Key West (Swain & Meek 1884, type; and Jordan 1884*a*); Snapper Banks (Jordan & Evermann 1896); and Cape Florida, Key West and Anclote Sponge Kraals (Evermann & Kendall coll., 1896).

164. Siphostoma floridæ Jordan & Gilbert. *Florida Pipe-fish.*
Pensacola (Jordan & Gilbert 1882, type; and Jordan & Evermann 1896); Pensacola Bay (Jordan & Stearns coll., Bean 1883); Key West (Jordan 1884*a*, and Swain & Meek 1884); Gordon Pass and Big Gasparilla (Henshall 1889); Key West, Anclote Sponge Kraals, and Cape Florida (Evermann & Kendall coll., 1896).

165. Siphostoma elucens (Poey). *Pipe-fish.*
Tortugas (Garman 1896).

166. Siphostoma scovelli Evermann & Kendall. *Pipe-fish.*
St. Johns River (A. H. Curtiss coll., Jordan 1880*a*, as *Siphonostoma*, sp.); Pensacola (Jordan & Gilbert 1882, as *S. affine*); Key West and east and west coasts (Jordan & Stearns coll. Bean 1883, as *S. affine*); Cedar Keys and Key West (Jordan & Swain 1884*a*, as *S. affine*); Key West (Jordan 1884*a*, as *S. affine*, and Swain & Meek 1884, as *S. affine*); Egmont Key (Jordan 1884*e*, as *S. affine*); Cards Sound, Barnes Sound, Key West, Marco, Big Gasparilla, Lemon Bay, Long Boat Key, and Garden Key (Henshall 1889, as *S. affine*); Lake Worth (Smith coll., 1895); Pelican Island, Titusville, and Cocoa (Evermann & Bean 1896); Cape Florida and Anclote Sponge Kraals (Evermann & Kendall coll., 1896); and St. Johns River to Lake Monroe, Palatka, Welaka, and Lake Monroe (Kendall coll., 1897).

167. Siphostoma louisianæ (Günther). *Louisiana Pipe-fish.*
San Marco Island (Velie coll., Goode & Bean 1879*b*, as *Syngnathus louisianæ*); Key West (Jordan 1884*a*, Swain & Meek 1884, and Jordan & Evermann 1896); Egmont Key (Henshall 1889); Cocoa and Titusville (Evermann & Bean 1896); Cape Florida and Anclote Sponge Kraals (Evermann & Kendall coll., 1896); and Tampa Bay (*Fish Hawk* coll., 1898).

168. Siphostoma fuscum (Storer).
St. Johns River (Goode 1879*a*, as *Syngnathus fuscus*).

169. Siphostoma crinigerum Bean & Dresel.
Pensacola (Bean & Dresel 1882, type); Key West (Jordan 1884*a*); and Pensacola to Key West (Jordan & Evermann 1896).

170. Corythroichthys albirostris Heckel.
Pensacola Snapper Banks (Jordan & Gilbert 1882, as *Siphostoma zatropis*, type, and Jordan & Evermann 1896, as *Siphostoma albirostris*); Key West (Jordan 1884*a*, as *S. zatropis*; Swain & Meek 1884, as *S. zatropis;* and Evermann & Kendall coll., 1896); Snapper Banks (Jordan 1884, as *S. zatropis*); and Tampa Bay (*Fish Hawk* coll., 1898).

171. Corythroichthys cayorum Evermann & Kendall.
Key West (Evermann & Kendall 1897, type).

HIPPOCAMPIDÆ. The Sea-Horses.

172. Hippocampus hudsonius De Kay. *Sea-horse.*
Pensacola (Stearns coll., Goode & Bean 1879*a*, as *H. antiquorum*); St. Johns River (Goode 1879*a*, as *H. antiquorum*); Key West (Jordan 1884*a*); Gulf shore (Wilcox 1886); Snapper Grounds (*Grampus* coll., Kendall 1889); Egmont Key (Henshall 1889); and Tampa (Henshall 1894).

173. Hippocampus punctulatus Guichenot. *Sea-horse.*
Key West (Jordan 1884*a*), and Tarpon Springs (Evermann & Kendall coll., 1896).

174. Hippocampus stylifer Jordan & Gilbert. *Sea-horse.*
Snapper Banks off Pensacola (Jordan & Gilbert 1882, type; and Jordan 1884).

175. Hippocampus zosteræ Jordan & Gilbert. *Sea-horse.*
Laguna Grande, Pensacola (Jordan & Gilbert 1882, type); west coast and Pensacola (Stearns coll., Bean 1883); west coast (Henshall 1889); Pensacola (Jordan & Evermann 1896); and Cape Florida and Key West (Evermann & Kendall coll., 1896).

APHREDODERIDÆ. The Pirate Perches.

176. Aphredoderus sayanus (Gilliams). *Pirate Perch.*

Santa Fe River (Woolman 1890), and Lake Monroe (Kendall coll., 1897).

ATHERINIDÆ. The Silversides.

177. Atherina stipes Müller & Troschel.

Florida Keys (Jordan 1884*d*); Barnes Sound, Florida Bay, and Cards Sound (Henshall 1889); and Tortugas (Garman 1896).

178. Atherina laticeps Poey. *Silversides; Hardhead.*

Clearwater Harbor (Velie coll., Goode & Bean 1879*b*, type of *A. veliana;* and Woodbury coll., Bean 1883); Key West (Jordan 1884*a*, Lönnberg 1894, as *A. veliana;* and Evermann & Kendall coll., 1896); Biscayne Bay (McCormick coll., Smith 1895); and Cape Florida (Smith coll., 1895).

179. Atherina aræa Jordan & Gilbert.

Key West (Jordan & Gilbert 1884*a*, type; Jordan 1884*a*; and Evermann & Kendall coll., 1896). This species is probably not distinct from *A. laticeps,* which may not be different from *A. stipes.*

180. Kirtlandia vagrans (Goode & Bean).

Pensacola (Stearns coll., Goode & Bean 1879*a*, type of *Chirostoma vagrans*); Cedar Keys (Jordan & Swain 1884*a*, as *Menidia vagrans*); Barnes Sound, Cape Romano, Cape Sable Creek, and Marco (Henshall 1889); Punta Rassa (*Fish Hawk* coll., 1889).

181. Menidia peninsulæ (Goode & Bean). *Silverside.*

Pensacola (Stearns coll., Goode & Bean 1879*a*, type of *Chirostoma peninsulæ;* Stearns coll., Bean 1883; Jordan & Gilbert 1882; and Jordan & Evermann 1896); Cedar Keys (Jordan & Swain 1884*a*); Barnes Sound, Marco, San Carlos Pass, Big Gasparilla, Myakka River, Sarasota Bay, and Long Boat Key (Henshall 1889); Punta Gorda, and Key West (Lönnberg 1894); Crocodile Hole in Indian Creek (Smith coll., 1895); Cocoa, Titusville, Indian River Inlet, and Pelican Island (Evermann & Bean 1896); Anclote Sponge Kraals (Evermann & Kendall coll., 1896); and Tampa Bay (*Fish Hawk* coll., 1898).

182. Menidia sp. incert.

St. Johns River (Cope 1877, as *Chirostoma beryllinum*); Lake Monroe (Baird coll., Goode & Bean 1879*a*, as *C. peninsulæ;* and Jordan & Evermann 1896, as *M. peninsulæ,* in part); South Lake at Titusville (Evermann & Bean coll., 1896); "Salt Lake" near Lake Butler (Evermann & Kendall coll., 1896); St. Johns River at Palatka, and Lake Monroe (Kendall coll., 1897).

183. Menidia menidia (Linnæus).

St. Johns River (Goode & Bean 1882, as type of *M. dentex;* and Baird coll., Bean 1883, as *M. dentex*).

184. Labidesthes sicculus (Cope). *Skipjack.*

Myakka River (Henshall 1889); Alligator River, Punta Gorda, Joshua, Charlie Apopka, and Oak creeks, Peace River at Zolfo Springs, Wauchula, and Bartow; Alligator Branch, Pemberton Creek, and Galliger Drain (Woolman 1890); Lake Ivanhoe near Orlando, and other lakes of the same system, in creeks connecting them, in single lakes in the pine land east of Orlando, and in other places in McDonald and Orange counties (Lönnberg 1894); Pelican Island (Evermann & Bean 1896); Lake Butler, Little River, and Anclote River at Pindar's Landing (Evermann & Kendall coll., 1896); Ocklawaha River, St. Johns River at Welaka, Satsuma and Lake Monroe (Kendall coll., 1897).

MUGILIDÆ. The Mullets.

185. Mugil curema Cuvier & Valenciennes. *White Mullet; Silver Mullet.*

Pensacola (Stearns coll., Goode & Bean 1879*a*, as *M. brasiliensis*); Indian River (Henshall coll., Jordan 1880, as *M. brasiliensis;* and Bean 1883, as *M. brasiliensis*); Florida Keys (Jordan 1884*d*, as *M. brasiliensis*); Key West (Jordan 1884*a*); Barnes

Sound, Cape Romano, Marco, Gordon Pass, and Big Estero Pass (Henshall 1889); San Carlos Bay (*Fish Hawk* coll., 1889); Gulf coast and Key West (Lönnberg 1894, as *M. brasiliensis*); Tampa (Henshall 1894); Indian River (Evermann & Bean 1896); and Tampa Bay (*Fish Hawk* coll., 1898).

186. Mugil cephalus Linnæus. *Common Mullet.*

St. Johns River and east coast (Goode 1879*a*, as *M. albula*); Pensacola (Stearns coll., Goode & Bean 1879*a*, as *M. albula*); St. Johns River (Bean 1883, as *M. albula;* Jordan & Meek 1884, as *M. albula*); Cedar Keys (Jordan & Swain 1884*a*, as *M. albula*); Key West (Jordan 1884*a*, as *M. albula*); Florida Keys (Jordan 1884*d*, as *M. albula*); Punta Gorda (*Fish Hawk* coll., 1889); Cape Sable Creek, west coast, and Garden Key (Henshall 1889); Tampa (Henshall 1894); "extremely abundant along Gulf coast, common on east coast, New Smyrna, St. Johns River and Lake Jessup" (Lönnberg 1894, as *M. albula*); Titusville and Pelican Island (Evermann & Bean 1896); and Tampa market, Tarpon Springs and Biscayne Bay (Evermann & Kendall coll., 1896).

187. Mugil gaimardianus Desmarest.

Florida Keys (Jordan & Swain 1884*b*).

188. Mugil trichodon Poey. *Fan-tail Mullet.*

Key West (Jordan 1884*a*); Key West and Florida Keys (Jordan & Swain 1884*b*, as *M. brasiliensis;* Henshall 1894); Florida Keys (Jordan 1884*d*, as *M. liza;* Henshall 1889, Jordan & Evermann 1896, and Evermann & Kendall coll., 1896).

189. Querimana gyrans Jordan & Gilbert. *Whirligig Mullet.*

Key West (Jordan & Gilbert 1884*a*, type; Jordan 1884*a*; and Jordan & Swain, 1884*b*); Marco, Gordon Pass and Myakka River (Henshall 1889); Lake Worth (Smith coll., 1895); Indian River Inlet, Pelican Island and Stuart (Evermann & Bean coll., 1896); and Tampa Bay (*Fish Hawk* coll., 1898).

SPHYRÆNIDÆ. The Barracudas.

190. Sphyræna barracuda (Walbaum). *Great Barracuda.*

Pensacola (Stearns coll., Goode & Bean 1879*a*, as *S. picuda;* and Jordan & Evermann 1896, as *S. picuda*); south Florida (Goode 1879*a*, as *S. picuda*); west Florida (Velie coll., Goode & Bean 1879*b*, as *S. picuda*); Key West (Jordan 1884*a*, as *S. picuda;* Lönnberg 1894, as *S. picuda;* and Evermann & Kendall coll., 1896); Florida Keys (Jordan 1884*d*, as *S. picuda*); Garden Key (*Grampus* coll., Kendall 1889, as *S. picuda*); Cards Sound, Key West, and west coast of Florida (Henshall 1889, as *S. picuda*); and Biscayne Bay (McCormick coll., Smith 1895, as *S. picuda*).

191. Sphyræna guachancho Cuvier & Valenciennes.

Pensacola (Stearns coll., Goode & Bean 1879*a*, as *S. guaguancho;* Stearns coll., Jordan 1884; and Jordan & Evermann 1896, as *S. guachancho*); and Key West (Henshall 1894, as *S. guaguanche*).

192. Sphyræna borealis De Kay. *Northern Barracuda.*

Key West (Evermann & Kendall coll., 1896).

POLYNEMIDÆ. The Threadfins.

193. Polydactylus virginicus (Linnæus). *Thread-fin; Barbudo.*

Key West (Jordan 1884*a*, as *Polynemus virginicus;* and Jordan & Evermann 1896).

194. Polydactylus octonemus (Girard).

Pensacola (Stearns coll., Goode & Bean 1879*a*, as *Polynemus octonemus;* and Bean 1883, as *P. octonemus*).

HOLOCENTRIDÆ. The Squirrel-Fishes.

195. Holocentrus ascensionis (Osbeck). *Squirrel-fish.*

Key West (Jordan 1884*a*, as *Holocentrum ascensione,* Henshall 1894, and Evermann & Kendall coll., 1896).

196. Holocentrus ascensionis rufus (Walbaum).

Florida Keys (Jordan 1884*d*, as *Bodianus rufus*).

MULLIDÆ. The Surmullets.

197. Mullus auratus Jordan & Gilbert. *Surmullet.*

Pensacola (Jordan & Gilbert 1882, as *M. barbatus auratus;* and Jordan & Evermann 1896); and Snapper Banks (Stearns coll., Jordan 1884).

198. Upeneus maculatus (Bloch). *Red Goat-fish.*

Key West (Jordan 1884*a*); Florida Keys (Jordan 1884*d*); Key West and Garden Key (Henshall 1889); and Tortugas (Garman 1896).

199. Upeneus martinicus Cuvier & Valenciennes.

Key West (Jordan 1884, as *U. balteatus;* and Jordan & Evermann 1896); and Florida (Jordan 1884*d*, as *U. balteatus*).

SCOMBRIDÆ. The Mackerels.

200. Scomber scombrus Linnæus. *Common Mackerel.*

Off coast of Florida 15 to 25 miles southeast of Cape Canaveral (reported by Capt. John Emmons, schooner *Belle of the Bay*, Collins 1887).

201. Scomber colias Gmelin. *Chub Mackerel.*

Pensacola (Jordan & Gilbert 1882, as *S. grex*, and 1883), and Snapper Banks (Stearns coll., Jordan 1884).

202. Auxis thazard (Lacépède). *Frigate Mackerel.*

Several places on Snapper Banks, caught by trolling (*Grampus* coll., Kendall 1889).

203. Gymnosarda alleterata (Rafinesque). *Little Tunny.*

Pensacola (Stearns coll., Goode & Bean 1879*a*, as *Orcynus alliteratus;* Bean 1883, as *O. alliteratus;* and Stearns coll., Jordan 1884, as *Euthynnus alliteratus*); Key West (Jordan 1884*a*, as *E. alliteratus*, and Henshall 1884, as *E. alliteratus*); and Florida Keys (Jordan 1884*d*, as *E. alliteratus*).

204. Sarda sarda (Bloch). *Bonito.*

Florida Keys and west coast (Henshall 1889); Key West (Henshall 1894); and Biscayne Bay (McCormick coll., Smith 1895).

205. Scomberomorus maculatus (Mitchill). *Spanish Mackerel.*

Pensacola (Stearns coll., Goode & Bean 1879*a*, as *Cybium maculatum;* and Jordan & Gilbert 1882); Charlotte Harbor (Henshall coll., Bean 1883); Key West (Jordan 1884*a*, and Evermann & Kendall coll., 1896); Florida Keys (Jordan 1884*d*); Tampa Bay and west coast (Henshall 1889); Key West and Tampa (Henshall 1894); Key West, St. Petersburg, and Clearwater Harbor (Lönnberg 1894); Biscayne Bay (McCormick coll., Smith 1895); and Santa Lucia Inlet (Evermann & Bean 1896).

206. Scomberomorus regalis (Bloch). *Sierra.*

Key West (Jordan 1884*a*, and Lönnberg 1894); Florida Keys (Jordan 1884*d*); near Egmont Key (*Grampus* coll., Kendall 1889); Key West and Florida Keys (Henshall 1889 and 1894); and Biscayne Bay (McCormick coll., Smith 1895).

207. Scomberomorus cavalla (Cuvier). *King-fish; Cero.*

Pensacola (Jordan & Gilbert 1882); Key West (Poey 1882, as *Cybium caballa;* Jordan 1884*a* and 1884*d*; and Lönnberg 1894, as *S. caballa*); Key West and Florida Keys (Henshall 1889 and 1894); Biscayne Bay (McCormick coll., Smith 1895); and Florida Keys (Jordan & Evermann 1896).

208. Acanthocybium solandri (Cuvier & Valenciennes). *Wahoo.*

Key West (Jordan 1884*a*); Florida Keys (Jordan 1884*d*, and Jordan & Evermann 1896).

TRICHIURIDÆ. The Cutlas-Fishes.

209. Trichiurus lepturus Linnæus. *Cutlas-fish; Machete.*

Pensacola (Stearns coll., Goode & Bean 1879*a*, and Jordan & Gilbert 1883); Jacksonville and elsewhere (Goode 1879*a*); Jacksonville (P. McQuaid coll., Bean 1883); Key West (Jordan 1884*a* and Evermann & Kendall coll., 1896); Florida Keys (Jordan 1884*d*); Snapper Banks (Stearns coll., Jordan 1884); Indian River and Titusville (Evermann & Bean coll., 1896); estuaries of St. Johns River (Goode & Bean 1896).

ISTIOPHORIDÆ. The Sail-Fishes.

210. Istiophorus nigricans (Lacépède). *Sail-fish.*
Between Savannah and Indian River (Goode 1879*a*, as *Histiophorus gladius*); Key West (Jordan coll., 1884*a*; Henshall 1889, as *H. americanus;* and Jordan & Evermann 1896).

XIPHIIDÆ. The Sword-Fishes.

211. Xiphius gladius Linnæus. *Common Sword-fish.*
Off mouth of St. Johns River (Goode 1879*a*).

CARANGIDÆ. The Pompanos.

212. Oligoplites saurus (Bloch & Schneider). *Leather-jacket.*
Tortugas (Jefferson, Porter & Moore 1878, as *Canthorhinus occidentalis*); west Florida (Velie coll., Goode & Bean 1879*b*, as *O. occidentalis*); Indian River (Jordan 1880, as *O. occidentalis;* and Evermann & Bean 1896); Pensacola (Jordan & Gilbert 1882, as *O. occidentalis*); Garden Key (Whitehurst & Baker coll., Bean 1883, as *O. occidentalis*); Key West (Jordan 1884*a*, and Henshall 1894); Florida Keys (Jordan 1884*d*); Cedar Keys (Jordan & Swain 1884*a*); west coast (Henshall 1889); and Biscayne Bay (McCormick coll., Smith 1895).

213. Seriola zonata (Mitchill). *Shark Pilot.*
West Florida coast and Snapper Banks (Goode 1881).

214. Seriola zonata carolinensis Holbrook.
Pensacola (Stearns coll., Goode & Bean 1879, as *S. stearnsii*, type; Goode 1879*a*, as *S. zonata;* Goode & Bean 1879*a*, as *S. stearnsii;* Jordan & Gilbert 1882, as *S. stearnsii;* Stearns coll., Bean 1883, as *S. carolinensis;* and Jordan & Evermann 1896).

215. Seriola lalandi Cuvier & Valenciennes. *Amber Jack.*
Pensacola (Jordan & Gilbert 1882); Key West (Jordan 1884*a*, and Henshall 1894); Florida Keys (Jordan 1884*d*, and Henshall 1889); and Biscayne Bay (McCormick coll., Smith 1895).

216. Seriola dumerili (Risso). *Amber Jack.*
Key West (Jordan 1884*a* and 1884*d*, and Henshall 1894), and Pensacola (Stearns coll., Jordan & Swain 1884*f*).

217. Seriola fasciata (Bloch). *Madregal.*
South Florida (Goode 1881, as *Zonichthys fasciatus*).

218. Seriola rivoliana Cuvier & Valenciennes.
Pensacola (Goode & Bean 1879, as *S. bonariensis*, and Goode 1881, as *S. bonariensis*).

219. Seriola falcata Cuvier & Valenciennes. *Madregal.*
Snapper Banks off Pensacola (Jordan & Gilbert 1882).

220. Elegatis bipinnulatus (Quoy & Gaimard). *Runner.*
West Florida (Würdemann coll., Goode & Bean 1879, as *E. pinnulatus*); Key West and Pensacola (Goode 1881, as *E. pinnulatus*); southern Florida (Würdemann coll., Bean 1883, as *E. pinnulatus*); and Key West (Jordan 1884*a*, as *E. pinnulatus*).

221. Decapterus punctatus (Agassiz). *Scad.*
Pensacola (Stearns coll , Goode & Bean 1879*a*; Goode 1881; Jordan & Gilbert 1882; and Stearns coll., Bean 1883); Pensacola and Snapper Banks (Stearns coll., Jordan 1884); Charlotte Harbor and Dry Tortugas (Henshall 1889); and Biscayne Bay (McCormick coll., Smith 1895).

222. Decapterus macarellus (Cuvier & Valenciennes). *Mackerel Scad.*
South Florida and Key West (Goode 1881).

223. Trachurus trachurus (Linnæus). *Saurel.*
Pensacola (Jordan & Gilbert 1882, as *Caranx trachurus*, and Jordan & Gilbert 1883, as *T. saurus;* and Jordan & Evermann 1886 and 1896); Snapper Banks (Stearns coll., Jordan 1884); and Little Sarasota Bay (Henshall coll., 1889), and Gulf of Mexico (Henshall 1889).

224. Trachurus crumenopthalmus (Bloch). *Big-eyed Scad.*

Key West (Goode 1881, as *Carangus crumenophthalmus*).

225. Hemicaranx amblyrhynchus (Cuvier & Valenciennes).

Pensacola (Stearns coll., Jordan 1884, as *Caranx amblyrhynchus*).

226. Caranx bartholomæi Cuvier & Valenciennes. *Yellow Jack.*

Key West (Jordan 1884*a*, and Evermann & Kendall coll., 1896); and Biscayne Bay (McCormick coll., Smith 1895).

227. Caranx hippos (Linnæus). *Crevalle.*

Massachusetts to Florida (Holbrook 1855*a*, as *C. defensor*); New York to Florida (Holbrook 1860, as *C. defensor*); Pensacola (Stearns coll., Goode & Bean 1879*a*, as *Carangus hippos*); mouth of St. Johns River (Goode 1879*a*, as *Carangus hippos*); Gulf of Mexico, Gulf coast, eastern Florida, Jacksonville, Indian River, Mosquito Inlet, Merritt Island, and Fort Capron (Goode 1881, as *Carangus hippos*); Key West (Jordan 1884*a*, and Evermann & Kendall coll., 1896); Florida Keys (Jordan 1884*d*); Cedar Keys (Jordan & Swain 1884*a*); west coast (Henshall 1889); Tampa and Key West (Henshall 1894); Biscayne Bay (McCormick coll., Smith 1895); and Indian River (Evermann & Bean 1896).

228. Caranx crysos (Mitchill). *Runner.*

Florida (Holbrook 1860, as *C. hippos*); Pensacola (Stearns coll., Goode & Bean 1879*a*, as *Paratractus pisquetus;* and Stearns coll., Bean 1883, as *C. chrysus*); near mouth of St. Johns River (Goode 1879*a*, as *P. pisquetus*); west Florida (Velie coll., Goode & Bean 1879*b*, as *C. pisquetus*); Indian River (Jordan 1880, as *Carangus chrysus*); Pensacola and Santa Rosa Sound (Goode 1881, as *Paratractus pisquetus*); Key West (Jordan 1884*a*, as *Caranx chrysos;* Henshall 1894; Lönnberg 1894, as *C. pisquetus;* Evermann & Kendall coll., 1896, and C. B. Hudson coll., 1897); Florida Keys (Jordan 1884*d*); west coast of Florida (Henshall 1889); and Biscayne Bay (McCormick coll., Smith 1895).

229. Caranx caballus (Günther). *Jurel.*

Key West (Poey 1882, as *Cybium caballa;* and Jordan & Evermann 1896).

230. Caranx latus Agassiz. *Horse-eye Jack.*

Key West (Jordan 1884*a*, and Henshall 1894); Florida Keys (Jordan 1884*d*); Tortugas (C. C. Nutting coll., Garman 1896, as *C. fallax*).

231. Alectis ciliaris (Bloch). *Thread-fish.*

Tortugas (Jefferson, Porter & Moore 1878, as *Blepharichthys crinitus*); Key West (Jordan 1884*a*, as *Caranx crinitus;* and Henshall 1894, as *C. crinitus*); and Florida Keys (Jordan 1884*d*, as *C. crinitus*).

232. Vomer setipinnis (Mitchill). *Moon-fish.*

Lower St. Johns River (Goode 1881, as *Argyriosus setipinnis*), and Pensacola (Stearns coll., Bean 1883; and Jordan 1884, as *Caranx setipinnis*).

233. Selene vomer (Linnæus). *Moon-fish.*

St. Johns River at Jacksonville (Goode 1879*a*, as *Argyreiosus vomer*); west Florida (Velie coll., Goode & Bean 1879*b*, as *S. argentea*); Indian River (Jordan 1880, as *S. argentea*); Key West (Jordan 1884*a*, and Evermann & Kendall coll., 1896); Florida Keys (Jordan 1884*d*); west coast (Henshall 1889); Key West and Tampa (Henshall 1894); Clearwater Harbor and Punta Gorda (Lönnberg 1894); Biscayne Bay (McCormick coll., Smith 1895); and Indian River (Evermann & Bean 1896).

234. Chloroscombrus chrysurus (Linnæus). *Bumper; Casabe.*

St. Johns River at Arlington (Goode 1879*a*); St. Johns and Indian rivers (Curtiss coll., Jordan 1880*a*); Pensacola (Stearns coll., Bean 1883); Garden Key (Whitehurst coll., Bean 1883); and Pensacola and Snapper Banks (Stearns coll., Jordan 1884).

235. Trachinotus glaucus (Bloch). *Palometa.*

Cape Florida to Gulf of Mexico (Holbrook 1860); Florida Keys (Jordan 1884*d*); and Pensacola (Jordan & Gilbert 1882); and Key West (Henshall 1894).

236. Trachinotus rhodopus Gill. *"Permit"; Pampanito.*

Key West (Jordan 1884*a*); Florida Keys (Jordan 1884*d*, and Lönnberg 1894); Loggerhead Key (Henshall 1889); and Tampa and Key West (Henshall 1894).

237. Trachinotus falcatus (Linnæus). *Round Pompano.*

Marquesas Keys (Velie coll., Goode & Bean 1879*b*, as *T. ovatus*); Pensacola (Goode 1881, as *T. ovatus*); Lake Worth (Henshall coll., Bean 1883, as *T. ovatus*); Key West (Jordan 1884*a*, as *T. rhomboides;* and Henshall 1889); Florida Keys (Jordan 1884*d*, as *T. rhomboides*); Clearwater Harbor (Lönnberg 1894, as *T. ovatus*); Biscayne Bay (McCormick coll., Smith 1895); Eau Gallie, Eden, and Stuart (Evermann & Bean 1896); and Tampa (in U. S. Fish Comm. reserve series).

238. Trachinotus goodei Jordan & Evermann. *"Permit."*

West Florida (Velie coll., Goode & Bean 1879*a*, as *T. goreensis*) and Jupiter Inlet (Blackford coll., Goode & Bean 1879*a*, as *T. goreensis*); west Florida (Velie coll., Goode & Bean 1879*b*, as *T. goreensis*); Jupiter Inlet, Key West, Sarasota Bay, Charlotte Harbor, and Cedar Keys (Goode 1881, as *T. goreensis*); Key West (Jordan & Evermann 1896, type); Biscayne Bay (McCormick coll., Smith 1895); Indian River (Evermann & Bean 1896).

239 Trachinotus carolinus (Linnæus). *Common Pompano; Pámpano.*

Pensacola (Stearns coll., Goode & Bean 1879*a;* Jordan & Gilbert 1882; and Stearns coll., Bean 1883); mouth of St. Johns River (Goode 1879*a*); Indian River, New Smyrna, Key West, Pensacola, Tampa Bay, and Charlotte Harbor (Goode 1881); Key West (Jordan 1884*a*); Cedar Keys (Jordan & Swain 1884*a*); Egmont Key (Jordan 1884*e*); Egmont Key and Gasparilla (Henshall 1889); Tampa and Key West (Henshall 1894); Punta Gorda, Clearwater Harbor, and Coronado Beach outside New Smyrna (Lönnberg 1894); Biscayne Bay (McCormick coll., Smith 1895); and Indian River (Evermann & Bean 1896).

POMATOMIDÆ. The Blue-Fishes.

240. Pomatomus saltatrix (Linnæus). *Blue-fish.*

Pensacola (Stearns coll., Goode & Bean 1879*a*, and Bean 1883); St. Johns River (Bean 1880 and 1883); Pensacola (Jordan & Gilbert 1882); Key West (Jordan 1884*a*); Florida Keys (Jordan 1884*d*); Lemon Bay (Henshall 1889); Tampa (Henshall 1894); Biscayne Bay (McCormick coll., Smith 1895); Indian River Inlet (Evermann & Bean 1896); and Florida Reefs (Garman 1896).

RACHYCENTRIDÆ. The Sergeant-Fishes.

241. Rachycentron canadus (Linnæus). *Sergeant-fish.*

Indian River (Goode 1879*a*, as *Elecate canadus*); Pensacola (Bean 1883, as *E. canadus*); Key West (Jordan 1884*a* and Henshall 1894, as *E. canada*); and Florida Keys (Jordan 1884*d*, as *E. canada*).

NOMEIDÆ.

242. Nomeus gronovii (Gmelin). *Portuguese Man-of-war Fish.*

Snapper Banks off Pensacola (Jordan & Gilbert 1882); Garden Key and Pensacola (Bean 1883); Key West and Florida Keys (Jordan 1884*a*); Snapper Banks (Stearns coll., Jordan 1884); Snapper Banks (*Grampus* coll., Kendall 1889); Gulf of Mexico (Henshall 1889); Tortugas (Garman 1896); and Key West (C. B. Hudson coll., 1897).

CORYPHÆNIDÆ. The Dolphins.

243. Coryphæna hippurus Linnæus. *Common Dolphin.*

Key West (Jordan 1884*a*, and Henshall 1894); Florida Keys (Jordan 1884*d*); and off Key West in 6 fathoms (Garman 1896, as *Coryphæna* sp?.).

244. Coryphæna equisetis Linnæus. *Small Dolphin.*

Pensacola (Stearns coll., Bean 1883, as *C. punctulatus*).

STEINEGERIDÆ.

245. Steinegeria rubescens Jordan & Evermann.

Snapper Banks, from stomach of red grouper (Jordan & Evermann 1886, type), and Snapper Banks (Jordan & Evermann 1896).

STROMATEIDÆ. The Butter-Fishes.

246. Rhombus paru (Linnæus). *Harvest-fish.*

Pensacola (Stearns coll., Goode & Bean 1879*a*, as *Peprilus alepidotus*); Fernandina (Goode 1879*a*, as *P. alepidotus;* and L. W. Ledyard coll., Bean 1883, as *Stromateus paru*); Egmont Key (Jordan 1884*e*, as *S. alepidotus*); and Snapper Banks (*Grampus* coll., Kendall 1889, as *S. paru*).

247. Rhombus triacanthus (Peck). *Butter-fish.*

Pensacola Snapper Banks (Stearns coll., Jordan 1884, as *Stromateus triacanthus*), and Lemon Bay and Big Sarasota Bay (Henshall 1889, as *S. triacanthus*).

ELASSOMATIDÆ. The Pigmy Sun-Fishes.

248. Elassoma evergladei Jordan. *Pigmy Sun-fish.*

Indian River and Lake Jessup (R. E. Earll coll., Jordan 1884*c*, type); Santa Fe River, Sampson Creek, New River, Withlacoochee River, Mill Creek and Pemberton Creek (Woolman 1890); Fern Creek and small lakes around Orlando, Tohopekaliga and other waters around Kissimmee, and Arcadia (Lönnberg 1894); Lake Butler (Evermann & Kendall coll., 1896); and Welaka and the Ocklawaha River (Kendall coll., 1897).

CENTRARCHIDÆ. The Sun-Fishes.

249. Pomoxis sparoides (Lacépède). *Calico Bass*; *"Spotted Perch."*

St. Johns River and tributaries (Goode 1879*a*, as *P. nigromaculatus*); St. Johns River (Bean 1880, as *P. nigromaculatus*); Escambia River (Bollman 1886); Lake Apopka and several other lakes in Orange County (Lönnberg 1894); and Lake Monroe, and Lake George at Volusia Bar (Kendall coll., 1897).

250. Centrarchus macropterus (Lacépède). *Flier.*

Florida (Bollman 1888, and Jordan & Evermann 1896).

251. Chænobryttus gulosus (Cuvier & Valenciennes). *Warmouth; "Perch-mouth Bream."*

St. Johns River (Holbrook 1855, type of *Calliurus floridensis*, and Bean 1880); Volusia (Cope 1877); St. Johns River and tributaries (Goode 1879*a*, as *C. viridis*); San Sebastian River (Henshall coll., Jordan 1880, as *C. viridis*); Escambia River (Bollman 1886); Myakka River and fresh ponds near Myakka River (Henshall 1889); Alligator River, Punta Gorda, Joshua, Charley Apopka and Oak creeks, Alligator Branch, Peace River at Wauchula and Bartow, Pemberton Creek, Galliger Drain, Mill Creek, Withlacoochee and Little Withlacoochee rivers, Pond Creek, Santa Fe River, Sampson Creek and New River (Woolman 1890); Fern Creek near Orlando, small lakes near Zellwood, Apopka Creek at Orlando, Lake Jessup in a small brook from sulphur springs, and ditches and ponds at Arcadia (Lönnberg 1894); Little River and Little Arch Creek (Smith coll., 1895); Tampa and Anclote River (Evermann & Kendall coll., 1896); and Palatka, Welaka, Georgetown and Lake Monroe (Kendall coll., 1897).

252. Enneacanthus obesus (Baird).

St. Johns River (Holbrook 1855, type of *Bryttus fasciatus;* and Jordan & Evermann 1896); Florida (Bollman 1888); Volusia (Cope 1877, as *E. fasciatus*); St. Johns River, Volusia and Bayport (Goode 1879*a*); Sebastian River (Henshall coll., Jordan 1880); and Myakka River (Henshall 1889).

253. Enneacanthus gloriosus (Holbrook).

Florida (Bollman 1888); small pond near Lake Beauty near Orlando (Lönnberg 1894, as *E. simulans*); Anclote River (Evermann & Kendall coll., 1896); and Palatka, Welaka, Volusia Bar and Lake Monroe (Kendall coll., 1897).

254. Apomotis punctatus (Cuvier & Valenciennes).

Volusia and east Florida (Cope 1877, as *Lepomis apiatus*); St. Johns River (Jordan 1877, as *Lepiopomus apiatus;* Bean 1880, as *L. punctatus*); Arlington and Jacksonville (Goode 1879*a*, as *Lepiopomus apiatus*); San Sebastian River (Henshall coll., Jordan 1880, as *L. punctatus*); St. Johns River (Goode coll., Bean 1883, as *Lepomis punctatus*); east Florida (streams flowing into Biscayne Bay) and Myakka River (Henshall 1889, as *L. punctatus*); Alligator River, Punta Gorda, Joshua, Charley Apopka and Oak creeks, Santa Fe River, Sampson Creek, and New River (Woolman 1890); small lake near Zellwood (Lönnberg 1894, as *L. punctatus*); Little Arch Creek, Little River, and Hillsboro River (Smith coll., 1895); Miami River (Evermann & Kendall coll., 1896); and Palatka, Welaka, St. Johns River at Fort Gates, Ocklawaha River, and sulphur springs at Welaka (Kendall coll., 1897).

255. Lepomis auritus (Linnæus). *Redbreast Bream.*

St. Johns River (Holbrook 1855, type of *Pomotis elongatus;* Bean 1880, as *Lepiopomus auritus;* Bean 1883; and Jordan & Evermann 1896, as *L. auritus solis*); Volusia and east Florida (Cope 1877, as *L. auritus* and as *L. mysticalis*, type); Florida (Jordan 1877, as *Lepiopomus elongatus et mysticalis*); St. Johns River and tributaries (Goode 1879*a*, as *Lepiopomus auritus*); St. Johns River at Palatka, sulphur springs at Welaka, and St. Johns River at Welaka, Ocklawaha River, Match Creek, Bear Creek, Fort Gates, Volusia Bar at head of Lake George, and Lake Monroe (Kendall coll., 1897).

256. Lepomis miniatus Jordan.

Fresh waters connected with Indian River (Jordan & Evermann 1896).

257. Lepomis megalotis (Rafinesque). *Long-eared Sunfish.*

St. Johns River (Holbrook 1855, type of *Pomotis marginatus;* Günther 1859, as *P. marginatus*); Florida (Jordan 1877, as *Xenotis marginatus*); Escambia River (Bollman 1886); New River, Pemberton Creek, Galliger Drain, Mill Creek, Charley Apopka Creek, Peace River at Zolfo Springs, Bartow, and at Wauchula (Woolman 1890).

258. Lepomis pallidus (Mitchill). *Blue-gill; "Blue Bream."*

Pensacola (Stearns coll., Goode & Bean 1879*a*, as *Lepiopomus incisor*); St. Johns River and all fresh and brackish waters in Florida (Goode 1879*a*, as *L. incisor*); San Sebastian River (Jordan 1880); St. Johns River (Bean 1880 and 1883; Jordan & Meek 1884); Escambia River (Bollman 1886); west Florida, Point Pinellas (Henshall 1889); Joshua Creek, Peace River at Zolfo Springs, Wauchula and Bartow, Alligator Branch, Pemberton Creek, Galliger Drain, Mill Creek, Withlacoochee River, Sampson Creek, and New River (Woolman 1890); Lake Apopka, Zellwood, Orange, Osceola and De Soto counties (Lönnberg 1894); Arch Creek (Smith coll., 1895); Eau Gallie Creek, South Lake, and fresh-water streams tributary to Indian River (Evermann & Bean 1896); and Palatka, Welaka, Fort Gates, Volusia Bar, and Lake Monroe (Kendall coll., 1897).

259. Eupomotis pallidus (Agassiz).

Garden Key (?) (Jordan 1877, type of *Xystroplites gillii*); "described from Key West [Garden Key]" (Goode 1879*a*, as *X. gilli*).

260. Eupomotis heros (Baird & Girard).

Florida (Jordan & Evermann 1896).

261. Eupomotis holbrooki (Cuvier & Valenciennes). *"Shell Cracker."*

St. Johns River (Holbrook 1855, type of *Pomotis speciosus;* Günther 1859, as *P. microlophus;* Goode 1879*a* and Bean 1880, as *E. speciosus*, and Bean 1883, as *Lepomis holbrookii;* Jordan & Meek 1884, as *L. holbrooki*); Volusia and Bayport (Cope 1877, as *Xystroplites longimanus*, type of genus and species); Pensacola (Stearns coll., Goode & Bean 1879*a*, as *E. speciosus*); Escambia River (Bollman 1886, as *Lepomis holbrooki*); Volusia and Bayport (according to Cope, Bollman 1888); Myakka River (Henshall

1889); Joshua, Charley Apopka, and Oak creeks, Peace River at Zolfo, Alligator Branch, Mill Creek, and Pond Creek (Woolman 1890, as *L. holbrooki*); Lake Apopka (Lönnberg 1894, as *Lepomis holbrookii*); Little Arch Creek and Hillsboro River (Smith coll., 1895); South Lake and Titusville (Evermann & Bean 1896); Tampa, Anclote River and Lake Butler (Evermann & Kendall coll., 1896); St. Johns River, Palatka, Welaka, Volusia Bar, and Lake Monroe (Kendall coll., 1897).

262. **Eupomotis gibbosus** (Linnæus). *Common Sun-fish.*

Maine to Florida (Holbrook 1855, as *Pomotis vulgaris*); Florida (Jordan 1877, as *E. aureus;* Bean 1883; and Jordan & Evermann 1896); and all fresh waters of Florida (Goode 1879*a*, as *E. aureus*).

263. **Micropterus salmoides** (Lacépède). *Large-mouthed Black Bass; "Trout."*

East Florida (Maclure, Ord, Say & Peale coll., Le Sueur 1822, as type of *Cichla floridana*, and according to Le Sueur, Bollman 1888); Florida (Holbrook 1855*a* and 1860, as *Grystes salmoides*); Pensacola (Stearns coll., Goode & Bean 1879*a*, as *Micropterus pallidus*); San Sebastian River (Henshall coll., Jordan 1880, as *M. pallidus*); St. Johns River (Curtis coll., Jordan 1880*a*, as *M. pallidus*, and Bean 1880, as *M. pallidus*); Wekiwachee River (Henshall coll., Bean 1883); Escambia River (Bollman 1886); Myakka River, Hillsborough River and tributaries (Henshall 1889); Joshua, Charley Apopka and Oak creeks, Peace River at Zolfo, Wauchula and Bartow, Alligator Branch, Pemberton Creek, and Galliger Drain (Woolman 1890); St. Johns River and lakes (Lönnberg 1894); Eau Gallie and South Lake (Evermann & Bean 1896); Palatka, Welaka, Match Creek, tributary to Ocklawaha River, and Lake Monroe (Kendall coll., 1897).

PERCIDÆ. The Perches.

264. **Hadropterus nigrofasciatus** Agassiz. *Crawl-a-bottom.*

Escambia River (Bollman 1886, as *Etheostoma nigrofasciatum*).

265. **Ammocrypta beanii** Jordan. *Sand Darter.*

Escambia River (Bollman 1886, as *Etheostoma beanii*).

266. **Copelandellus quiescens** (Jordan).

Alligator River, Joshua Creek, Alligator Branch, Pemberton Creek, Mill Creek, Withlacoochee and Little Withlacoochee rivers, Pond Creek, Santa Fe River, Sampson Creek, New River (Woolman 1890, as *Etheostoma quiescens*); Fern Creek near Orlando, in many localities, small lakes south of Orlando, Lake John near Oakland, and small lakes near McDonald (Lönnberg 1894, as *E. quiescens*); Lake Butler, and pond near Tampa (Evermann & Kendall coll., 1896); and St. Johns River at Welaka, lake near Welaka, and Lake Monroe (Kendall coll., 1897).

267. **Boleichthys fusiformis** (Girard).

Florida (Holbrook 1855, as *Boleosoma barratti*); Titusville (Earll coll., Jordan 1884*c*, as *Pœcilichthys barratti*, and Evermann & Bean 1896).

CHEILODIPTERIDÆ. The Kings of the Mullets.

268. **Apogon imberbis** (Linnæus). *King of the Mullets; Alfoncino; Fucinita.*

Tortugas (Jefferson, Porter & Moore 1878).

269. **Apogon maculatus** (Poey).

Pensacola Snapper Banks (Jordan & Gilbert 1882; and Stearns coll., Jordan 1884); Snapper Banks and Pensacola (Jordan & Evermann 1896).

270. **Apogonichthys alutus** (Jordan & Gilbert).

Pensacola (Jordan & Gilbert 1882, type of *Apogon alutus*); Snapper Banks (Stearns coll., Jordan 1884, as *Apogon alutus*); and off Tampa (Jordan & Evermann 1896).

271. **Apogonichthys puncticulatus** Poey.

Tortugas (Garman 1896, as *Amia puncticulatus*).

272. **Glossamia pandionis** (Goode & Bean).

Lat. 28° 45′ N., long. 86° 26′ W., in 227 fathoms, southward of Pensacola (Goode & Bean 1896).

273. Hypoclydonia bella Goode & Bean.
Lat. 28° 42′ N., long. 86° 36′ W., in 280 fathoms, southward of Pensacola, and lat. 28° 38′ 30″ N., long. 85° 52′ 30″ W., southward of Cape San Blas (Goode & Bean 1896).

CENTROPOMIDÆ. The Robalos.

274. Centropomus undecimalis (Bloch). *"Snook"; Sergeant-fish; Robalo.*
Jupiter Inlet (Goode 1879*a*); Key West and Florida Keys (Jordan 1884*d*); west coast (Lönnberg 1894); Biscayne Bay (McCormick coll., Smith 1895); west coast and Cards Sound (Henshall 1889); Tampa (Henshall 1894); Indian River (Evermann & Bean 1896); Key West (Evermann & Kendall coll., 1896); and Tampa Bay (*Fish Hawk* coll., 1898).

SERRANIDÆ. The Sea Basses.

275. Roccus lineatus (Bloch). *Striped Bass; Rock-fish; Rock.*
Pensacola (Stearns coll., Goode & Bean 1879*a*); St. Johns River (Goode 1879*a*); Florida (Bean 1883, as *R. saxatilis*); and Escambia River (Bollman 1886).

276. Petrometopon cruentatus Lacépède. *Coney; Rock Hind; Enjambre.*
Southern keys and reefs (Henshall 1894, as *Bodianus cruentatus*); Key West (Evermann & Kendall coll., 1896); and Florida (Jordan & Evermann 1896).

277. Petrometopon cruentatus coronatus (Cuvier & Valenciennes).
Key West (Jordan 1884*a*, as *Epinephelus guttatus;* and Jordan & Evermann 1896); Florida Keys (Jordan & Swain 1884*d*, as *Epinephelus guttatus coronatus*, and Jordan 1884*d*, as *Epinephelus guttatus*); and Key West and Tortugas (Henshall 1889, as *Enneacentrus guttatus*).

278. Bodianus tæniops (Cuvier & Valenciennes).
Florida (Jordan & Swain 1884*d*, as *Enneacentrus tæniops;* and Jordan & Evermann 1896).

279. Bodianus fulvus (Linnæus.) *"Nigger-fish."*
Key West (Henshall 1889, as *Enneacentrus fulvus*, and 1894); Tortugas (Garman 1896, as *Epinephelus guatevere*); and Florida Keys (Jordan & Evermann 1896).

280. Bodianus fulvus punctatus (Linnæus). *"Nigger-fish."*
Key West (Lönnberg 1894); and Biscayne Bay (McCormick coll., Smith 1895).

281. Epinephelus adscensionis (Osbeck). *Rock Hind; Cabra Mora.*
Key West (Poey 1882, as *E. punctatus;* Jordan 1884*a*, as *E. ascensionis;* Henshall 1889, as *E. ascensionis*, and Henshall 1894; Evermann & Kendall coll., 1896, and C. B. Hudson coll., 1897); Florida Keys (Jordan 1884*d*, Jordan & Swain 1884*d*, as *E. ascensionis*, and Jordan & Evermann 1896); and Biscayne Bay (McCormick coll., Smith 1895).

282. Epinephelus flavolimbatus Poey. *"Yellow-finned Grouper."*
Key West (Henshall 1894), and Pensacola (Jordan & Evermann 1896).

283. Epinephelus niveatus (Cuvier & Valenciennes).
Pensacola (Jordan & Evermann 1886).

284. Epinephelus striatus (Bloch). *"Nassau Grouper"; Cherna Criolla.*
Key West (Jordan 1884*a*, Jordan & Swain 1884*d*, Henshall 1894, Jordan & Evermann 1896, Evermann & Kendall coll., 1896, and C. B. Hudson coll., 1897); Florida Keys (Jordan 1884*d*); and Key West and Florida Keys (Henshall 1889).

285. Epinephelus maculosus (Cuvier & Valenciennes). *"Red Hind"; Cabrilla.*
Key West (Poey 1882, as *E. lunulatus*); Florida Keys and Tortugas (Jordan & Eigenmann 1888, as *E. catus*); Garden Key (Henshall 1889, as *E. apua*); Evermann & Kendall coll., 1896; and C. B. Hudson coll., 1897); Biscayne Bay (McCormick coll., Smith 1895); and Florida Keys (Jordan & Evermann 1896).

286. Epinephelus drummond-hayi Goode & Bean. *"Speckled Hind"; John Paw.*
Pensacola (Goode & Bean 1878*a*, type, and 1879*a;* Jordan & Gilbert 1882; and Jordan & Evermann 1896); and Key West (Jordan 1884*a*).

287. Epinephelus morio (Cuvier & Valenciennes). *Red Grouper.*

Key West (Holbrook 1855*a* and 1860, as *Serranus erythrogaster;* Poey 1882, Bean 1883, Jordan 1884*a*, Lönnberg 1894, Henshall 1894, Evermann & Kendall coll., 1896, and C. B. Hudson coll., 1897); Pensacola (Stearns coll., Goode & Bean 1879*a*, and Jordan & Gilbert 1882); St. Johns River, etc., and Indian River (Goode 1879*a*); Florida Keys (Jordan & Swain 1884*d;* Jordan 1884*d*); Key West (Jordan 1884*a*); Key West and Florida Keys (Henshall 1889); Snapper Grounds, in 15 to 37 fathoms (*Grampus* coll., Kendall 1889); and Biscayne Bay (McCormick coll., Smith 1895).

288. Garrupa nigrita (Holbrook). *Black Grouper.*

Pensacola (Goode & Bean 1878*c*, as *Epinephelus nigritus*, and Stearns coll., Goode & Bean 1879*a*, as *E. nigritus*); Indian River and west Florida (Goode 1879*a*, as *E. nigritus*); Snapper Grounds, 19½ to 48 fathoms (*Grampus* coll., Kendall 1889, as *E. nigritus*); Marco, Gordon Pass, Jupiter Inlet, Caximbas Pass, Gilbert Inlet, Little Gasparilla Inlet, and Charlotte Harbor (Henshall 1889, as *E. nigritus;* perhaps all of these belong to *Promicrops guttatus*); Key West and Punta Gorda (Lönnberg 1894, as *E. nigritus*); and Pensacola (Jordan & Evermann 1896).

289. Promicrops guttatus (Linnæus). *Guasa; Spotted Jew-fish.*

New Berlin (Goode 1879*a*, as *P. guasa*); Key West (Poey 1882, as *P. guasa;* Jordan 1884*a*, as *Epinephelus itaiara;* Henshall 1894, Jordan & Evermann 1896, Evermann & Kendall coll., 1896, and C. B. Hudson coll., 1897); Florida Keys (Jordan 1884*d*, as *E. itaiara*); and Indian River Inlet and Fort Pierce (Evermann & Bean 1896).

290. Dermatolepis zanclus Evermann & Kendall.

Key West (Evermann & Kendall 1897, type).

291. Mycteroperca venenosa (Linnæus). *"Yellow-finned Grouper."*

Key West (Poey 1882, as *Trisotropis petrosus;* Jordan 1884*a*, as *Epinephelus venenosus;* Evermann & Kendall coll., 1896, and C. B. Hudson coll., 1897); Florida Keys (Jordan & Swain 1884*d;* Jordan 1884*d*, as *Epinephelus venenosus*, and Jordan & Evermann 1896); and Southern Keys (Henshall 1894).

292. Mycteroperca venenosa apua (Bloch). *Bonaci Cardenal; "Red Hind."*

Garden Key (Henshall 1889, as *E. venenosa apua*); Key West (Lönnberg 1894, as *E. guttatus*); and Florida Keys (Jordan 1884*a*, as *E. apua;* Jordan & Swain 1884*d*, and Jordan & Evermann 1896).

293. Mycteroperca bonaci (Poey). *Marbled Rock-fish.*

Pensacola (Goode & Bean 1879*a*, as *Trisotropis brunneus*); Key West (Poey 1882, as *Trisotropis brunneus* and *T. aguaji;* Jordan 1884*a*, as *Epinephelus bonaci;* Jordan & Swain 1884*d;* Henshall 1894; Jordan & Evermann 1896; Evermann & Kendall coll., 1896; and C. B. Hudson coll., 1897); Florida Keys (Jordan 1884*d*); and Key West and west coast (Henshall 1889).

294. Mycteroperca bonaci xanthosticta Jordan & Swain.

Pensacola (Jordan & Swain 1884*d*, type), and Snapper Banks (Jordan & Evermann 1896).

295. Mycteroperca microlepis (Goode & Bean). *"Gag"; Aguaji.*

Pensacola (Stearns coll., Goode & Bean 1879*a*, type of *Trisotropis microlepis;* Goode & Bean 1882, as type of *T. stomias;* Jordan & Gilbert 1882, as *T. stomias;* Bean 1883, as *T. stomias;* and Jordan 1884, as *Epinephelus stomias*); Key West and Cedar Keys (Jordan 1884*a*, as *E. microlepis;* Jordan & Swain 1884*d*, as *E. microlepis;* Henshall 1889 and 1894; Lönnberg 1894; Evermann & Kendall coll., 1896; and C. B. Hudson coll., 1897); Florida Keys (Jordan 1884*d*); Cedar Keys (Jordan & Swain 1884*a*, as *E. stomias*); and Key West and Pensacola (Jordan & Evermann 1896).

296. Mycteroperca falcata phenax Jordan & Swain. *"Scamp"; Bacalao.*

Pensacola (Stearns coll., Goode & Bean 1879*a*, as *Trisotropis falcatus;* and Jordan & Gilbert 1882, as *T. falcatus*); Key West (Poey 1882, as *T. falcatus;* Lönnberg 1894, as *T. falcata*); Key West and Pensacola (Jordan 1884*a*, as *Epinephelus falcatus;* Jordan & Evermann 1896; Evermann & Kendall coll., 1896; and C. B. Hudson coll., 1897); Florida Keys (Jordan 1884*d*, as *E. falcatus*); coast of Florida, Key West, and Pensacola Snapper Banks (Jordan & Swain 1884*d*, as type of *M. falcata phenax*); Key West, Ironwood Key, and Key Largo (Henshall 1889); Florida Keys, Key West, and Snapper Banks (Henshall 1894, as *M. falcata*); and Biscayne Bay (McCormick coll., Smith 1895).

297. Hypoplectrus unicolor (Walbaum). *Vaca; Petit-nègre.*
Key West (Evermann & Kendall coll., 1896).

298. Hypoplectrus unicolor nigricans (Poey).
Florida Keys (Jordan 1884*a*).

299. Hypoplectrus gemma Goode & Bean.
Garden Key (Goode & Bean 1882, type; and Jordan & Evermann 1896); and Florida Keys (Jordan 1884*a*).

300. Centropristes striatus (Linnæus). *Black Sea Bass; "Tally-wag."*
Cape Florida to Cape Fear River (Holbrook 1855*a* and 1860, as *C. atrarius*); entire eastern coast (Goode 1879*a*, as *C. atrarius*); Matanzas River Inlet (Bean 1883, as *Serranus atrarius*); Florida (Bean 1880, as *C. atrarius*).

301. Centropristes ocyurus (Jordan & Evermann). *Gulf Sea Bass.*
Pensacola (Goode & Bean 1879*a*, as *C. atrarius;* Stearns coll., Jordan & Gilbert 1882, as *S. trifurcus;* Jordan & Evermann 1886, type); Pensacola Snapper Banks (Bean 1883, as *Serranus trifurcus*); Cedar Keys (Jordan & Swain 1884*a*, as *S. atrarius*); Tampa Bay (Henshall 1889, as *S. atrarius*); Tampa (Henshall 1894, as *C. striatus*); and Snapper Banks (Jordan & Evermann 1896).

302. Centropristes philadelphicus (Linnæus).
Pensacola (Jordan & Gilbert 1883, as *Serranus philadelphicus*), and Snapper Banks (Stearns coll., Jordan 1884, as *S. philadelphicus*).

303. Diplectrum formosum (Linnæus). *Squirrel-fish.*
Key West (Jordan 1884*a*, as *Serranus formosus;* Evermann & Kendall coll., 1896; and C. B. Hudson coll., 1897); Pensacola and Snapper Banks (Jordan 1884, as *S. formosus*); Florida Keys (Jordan 1884*d*, as *S. formosus*); Snapper Grounds, entrance to Charlotte Harbor (*Grampus* coll., Kendall 1889, as *S. formosus*); Key West and Gordon Pass (Henshall 1889, as *S. formosus*); Charlotte Harbor (*Fish Hawk* coll., 1889); Key West (Henshall 1894); Biscayne Bay (McCormick coll., Smith 1895; and Jordan & Evermann 1896); and Tampa Bay (*Fish Hawk* coll., 1898).

304. Prionodes phœbe (Poey). *Phœbe.*
Pensacola and Snapper Banks (Stearns coll., Jordan 1884, as *Serranus phœbe*); and Snapper Banks (*Grampus* coll., Kendall 1889, as *Prionodes* sp. ?).

305. Dules subligarius (Cope).
Pensacola (Cope 1870, type of *Centropristes subligarius;* Jordan & Gilbert 1882, as *Serranus subligarius;* and Stearns coll., Goode & Bean 1879*a*, as *Haliperca subligaria*); Snapper Banks (Stearns coll., Jordan 1884, as *S. subligarius*); and Big Gasparilla and Lemon Bay (Henshall 1889, as *S. subligarius*).

306. Hemianthias vivanus (Jordan & Swain).
Pensacola (Stearns coll., Jordan & Swain 1884*f*, type of *Anthias vivanus*); and from stomach of red hind from Snapper Banks (Jordan & Evermann 1886).

307. Rypticus saponaceus (Bloch & Schneider). *Soap-fish.*
Pensacola Snapper Banks (Stearns coll., Jordan 1884).

308. Rypticus bistrispinus (Mitchill).
Key West (Velie coll., Goode & Bean 1879*b*, as *R. pituitosus;* Jordan 1884*a*, as *R. bistrispinosus;* and Henshall 1894, as *R. bistripinnis*); Pensacola and Snapper Banks (Stearns coll., Jordan 1884, as *R. maculatus*); and Snapper Banks (*Grampus* coll., Kendall 1889, as *R. pituitosus*).

LOBOTIDÆ. The Triple-Tails.

309. Lobotes surinamensis (Bloch). *Flasher; Triple-tail.*

New York to Florida (Holbrook 1860); St. Johns River at Arlington (Goode 1879*a*); Pensacola (Stearns coll., Jordan & Swain 1884*f*); and Tampa (Henshall 1894); Indian River (Evermann & Bean 1896).

PRIACANTHIDÆ. The Catalufas.

310. Priacanthus arenatus Cuvier & Valenciennes. *Catalufa.*

Key West (Henshall 1894, as *P. catalufa*).

311 Pseudopriacanthus altus (Gill).

Pensacola (Jordan & Evermann 1896); and lat. 24° 25′ N., long. 81° 46′ 45″ W., southward of Key West (Goode & Bean 1896).

LUTIANIDÆ. The Snappers.

312. Neomænis griseus (Linnæus). *Gray Snapper; "Mangrove Snapper"; Caballerote.*

Pensacola (Goode & Bean 1878*b*, type of *Lutjanus stearnsii;* and 1879*a*, as *L. stearnsii;* Jordan & Gilbert 1882, as *L. stearnsii;* and Stearns coll., Jordan 1884, as *L. caballerote*); Key West (Poey 1882, as *L. caballerote;* and Jordan 1884*d*, as *L. stearnsii;* C. B. Hudson coll., 1897; and Jordan & Evermann 1898); Pensacola and Indian River (R. E. Earll coll., Bean 1883, as *L. stearnsii*); Cedar Keys (Jordan & Swain 1884*a*, as *L. caballerote*); Florida Keys (Jordan 1884*d*, as *L. caballerote;* and Henshall 1894, as *L. griseus*); Key West and Myakka River (Henshall 1889, as *L. griseus*); Biscayne Bay (McCormick coll., Smith 1895); Lake Worth (Smith coll., 1895); Fort Pierce and southward (Evermann & Bean 1896); Little River, Miami River at Miami, Key West, and Tarpon Springs (Evermann & Kendall coll., 1896); and Tampa Bay (*Fish Hawk* coll., 1898).

313. Neomænis jocu (Bloch & Schneider). *Dog Snapper; Jocú.*

Key West (Jordan 1884*a*, as *Lutjanus jocú;* Henshall 1894, as *L. jocu;* and C. B. Hudson coll., 1897); Florida Keys (Jordan & Swain 1884*e*, as *L. jocú;* Jordan 1884*d*, as *L. jocú;* and Jordan & Evermann 1898).

314. Neomænis apoda (Walbaum). *"Schoolmaster"; Caji.*

West Florida (Kaiser & Martin coll., Goode & Bean 1879*a*, as *Lutjanus caxis*); Pensacola (Jordan & Gilbert 1882, as *L. caxis;* and Stearns coll., Bean 1883, as *L. caxis*); Indian River (Henshall coll., Jordan 1880, as *L. caxis*); Key West (Jordan 1884*a*, as *L. caxis;* Henshall 1894, as *L. caxis;* Lönnberg 1894, as *L. caxis;* C. B. Hudson coll., 1897; and Jordan & Evermann 1898); Florida Keys (Jordan & Swain 1884*e*, as *L. caxis*); Cards Sound, Key West, Big Gasparilla, and west coast (Henshall 1889, as *L. caxis*); Captiva Pass (O. P. Hay coll., 1894–95); Biscayne Bay (McCormick coll., Smith 1895); Indian River Inlet (Evermann & Bean 1896); and Key West, Tarpon Springs, Anclote Sponge Kraals, and Miami (Evermann & Kendall coll., 1896).

315. Neomænis vivanus (Cuvier & Valenciennes). *Silk Snapper; Pargo de lo Alto.*

Pensacola (Jordan & Swain 1884*e*, as *Lutjanus vivanus*). This should probably be referred to *N. aya.*

316. Neomænis aya (Bloch). *Red Snapper.*

Snapper Banks off Pensacola (Stearns coll., Goode & Bean 1878*b*, type of *Lutjanus blackfordii*); Pensacola (Goode & Bean 1879*a*, as *L. blackfordii;* Jordan & Gilbert 1882, as *L. blackfordi;* Stearns coll., Bean 1883, as *L. blackfordii;* and Jordan 1884*a*, as *L. campechianus*); St. Johns Bar (Goode 1879*a*, as *L. blackfordii*); Key West (Poey 1882, as *L. campechianus;* Jordan 1884, as *L. campechianus;* C. B. Hudson coll., 1897; and Evermann coll., 1899); Cedar Keys (Jordan & Swain 1884*a*, as *L. campechianus*); Florida Keys (Jordan 1884*d*, as *L. campechianus*); Egmont Key (Jordan 1884*e*, as *L. campechianus*); between Tampa and Tortugas, in 25 to 27 fathoms (Collins 1886, as

Red Snapper); Snapper Grounds, in 15 to 48 fathoms (*Grampus* coll., Kendall 1889, as *L. blackfordii*); Key West and Snapper Banks (Henshall 1889, as *L. aya*, and Lönnberg 1894, as *L. aya*); Tampa (Henshall 1894, as *L. blackfordii*); and Biscayne Bay (McCormick coll., Smith 1895).

317 **Neomænis analis** (Cuvier & Valenciennes). *Mutton-fish; Pargo.*

Key West (Jordan 1884*a*, as *Lutjanus analis;* Henshall 1894, as *L. analis;* Evermann & Kendall coll., 1896; and C. B. Hudson coll., 1897); Florida Keys (Jordan & Swain 1884*e*, as *L. analis;* and Jordan 1884*d*, as *L. analis*); west coast (Henshall 1889, as *L. analis;* Biscayne Bay (McCormick coll., Smith 1895); and Key West and Pensacola (Jordan & Evermann 1898).

318. **Neomænis synagris** (Linnæus). *Lane Snapper.*

Key West (Poey 1882 and Jordan 1884*a*, as *Lutjanus synagris;* Henshall 1894, as *L. synagris;* Lönnberg 1894, as *L. synagris;* Evermann & Kendall coll., 1896; and C. B. Hudson coll., 1897); Pensacola and west coast (Stearns coll., Bean 1883, as *L. synagris*); Pensacola (Jordan & Swain 1884*e*, as *L. synagris*); Florida Keys (Jordan 1884*d*, as *L. synagris*); Barnes Sound, Key West, Florida Keys, and Lemon Bay (Henshall 1889, as *L. synagris*); Biscayne Bay (McCormick coll., Smith 1895, as *L. synagris*); Indian River Inlet (Evermann & Bean 1896); and Florida Keys and Tampa (Jordan & Evermann 1898).

319. **Ocyurus chrysurus** (Bloch). *Yellow-tail; Rabirubia.*

Key West (Poey 1882, Jordan 1884*a*, Henshall 1894, Lönnberg 1894, Evermann & Kendall coll., 1896, C. B. Hudson coll., 1897, and Jordan & Evermann 1898); Florida Keys (Jordan 1884*d*); Key West and Florida Keys (Henshall 1889); and Biscayne Bay (McCormick coll., Smith 1895).

320. **Rhomboplites aurorubens** (Cuvier & Valenciennes). *Cargon de lo Alto.*

Pensacola (Stearns coll., Goode & Bean 1879*a*; Jordan & Gilbert 1883, as *Aprion ariommus*, type; Jordan & Swain 1884*e*; and Jordan & Evermann 1898); and Pensacola and Snapper Grounds (Stearns coll., Jordan 1884).

HÆMULIDÆ. The Grunts.

321. **Hæmulon album** Cuvier & Valenciennes. *"Margate-fish."*

Key West (Poey 1882; Jordan 1884*a*, as *H. gibbosum*, Henshall 1894; Evermann & Kendall coll., 1896; and C. B. Hudson coll., 1897); Florida Keys (Jordan & Swain 1884*c*, as *H. gibbosum;* Jordan 1884*d*, as *H. gibbosum;* and Jordan & Evermann 1898).

322. **Hæmulon macrostoma** Günther. *Gray Grunt.*

Clearwater Harbor (Velie coll., Goode & Bean 1879*b*, type of *H. fremebundum*); Garden Key (Whitehurst coll., Bean 1883, as *Diabasis fremebundus*); southern Florida (Jordan & Swain 1884*c*, as *H. fremebundum*); Key West (Bean & Dresel 1884, as *H. fremebundum;* Evermann & Kendall coll., 1896; and Jordan & Evermann 1898); and Indian River Inlet (Evermann & Bean 1896).

323. **Hæmulon parra** (Desmarest). *Sailor's Choice; Ronco Blanco.*

Garden Key and Florida Keys (Whitehurst coll., Bean 1883, as *Diabasis chromis*); Key West (Jordan 1884*a*; Henshall 1894; Lönnberg 1894; and Evermann & Kendall coll., 1896); southern Florida (Jordan & Swain 1884*c*, as *H. acutum*); Florida Keys (Jordan 1884*d*, as *H. parra*); Cards Sound, Key West, Marco, and Lemon Bay (Henshall 1889); Biscayne Bay (McCormick coll., Smith 1895); and southern Florida and Key West (Jordan & Evermann 1898).

324. **Hæmulon sciurus** (Shaw). *Yellow Grunt; "Boar Grunt."*

Key West (Henshall coll., Bean 1883, as *Diabasis elegans;* Jordan 1884*a*; Lönnberg 1894, as *H. elegans;* Henshall 1894; and Evermann & Kendall coll., 1896); Garden Key (*Grampus* coll., Kendall 1889); Garden Key and Key West (Henshall 1889); Biscayne Bay (McCormick coll., Smith 1895); Tortugas (Garman 1896); and Florida Keys (Jordan & Swain 1884*c*, Jordan 1884*d*, and Jordan & Evermann 1898).

325. Hæmulon plumieri (Lacépède). *Common Grunt; Ronco Ronco.*

Florida (Holbrook 1860, as *H. arcuatum*); St. Augustine (Goode 1879*a*, as *H. arcuatum*); Pensacola (Jordan & Gilbert 1882, as *Diabasis formosus*); Key West (Henshall coll., Bean 1883, as *D. plumieri;* Jordan 1884*a*; Henshall 1889 and 1894; Lönnberg 1894, as *H. formosum;* and Jordan & Evermann 1898); west Florida (Jordan & Swain 1884*c*); Florida Keys (Jordan 1884*d*); Cedar Keys (Jordan & Swain 1884*a*); Ozona (Lönnberg 1894); Biscayne Bay (McCormick coll., Smith 1895); Tortugas (Garman 1896); and Key West, Miami, and Anclote Sponge Kraals (Evermann & Kendall coll., 1896).

326. Hæmulon flavolineatum (Desmarest). *French Grunt.*

Key West (Jordan 1884*a*, Henshall 1894, and Jordan & Evermann 1898); Florida Keys (Jordan & Swain 1884*c*, and Jordan 1884*d*); and Tortugas (Garman 1896, as *H. canna*).

327. Brachygenys chrysargyreus (Günther).

Key West (Jordan 1884*a*, as *Hæmulon tæniatum*), and Florida Keys (Jordan & Swain 1884*c*, as *H. tæniatum*).

328. Bathystoma rimator (Jordan & Swain). *Tom-tate; Red-mouth Grunt.*

Pensacola (Jordan & Gilbert 1882, as *Diabasis aurolineatus*); Snapper Grounds (*Grampus* coll., Kendall 1889, as *Hæmulon rimator*); Key West and Florida Keys (Henshall 1889, as *H. rimator*); Key West (Henshall 1894, as *H. rimator;* Bean 1883, as *D. chrysopterus*); Biscayne Bay (McCormick coll., Smith 1895, as *H. rimator*); and Pensacola and Key West (Jordan & Swain 1884*c*, as *H. rimator*, and Jordan & Evermann 1898).

329. Bathystoma aurolineatum (Cuvier & Valenciennes). *Jeniguano.*

Pensacola (Stearns coll., Bean 1883, as *Diabasis aurolineatus*); Florida Keys and Garden Key (Whitehurst coll., Bean 1883, as *D. jeniguano*); Florida Keys (Jordan & Swain 1884*c*; and Jordan 1884*d*, as *Hæmulon aurolineatum*); Key West and Tortugas (Jordan 1884*a*, as *H. aurolineatum* and *H. jeniguano*); Snapper Banks (Stearns coll., Jordan 1884, as *H. aurolineatum*); and Garden Key and Florida Keys (Jordan & Evermann 1898).

330. Bathystoma striatum (Linnæus). *White Grunt.*

Key West (Lönnberg 1894, as *Hæmulon trivittatum*).

331. Anisotremus surinamensis (Bloch). *Pompon.*

Indian River (Evermann & Bean 1896, and Jordan & Evermann 1898), and Tortugas (Garman 1896).

332. Anisotremus tæniatus Gill. *Catalina.*

Florida Keys (Jordan 1884*d*, as *Hæmulon tæniatum*).

333. Anisotremus virginicus (Linnæus). *Pork-fish.*

Key West (Wm. Stimpson coll., Bean 1883; Jordan 1884*a*, as *Pomadasys virginicus;* Henshall 1889 and 1894; Lönnberg 1894; Evermann & Kendall coll., 1896; and C. B. Hudson coll., 1897); Florida Keys (Jordan 1884*d*, as *P. virginicus*); and Biscayne Bay (McCormick coll., Smith 1895).

334. Orthopristes chrysopterus (Linnæus). *Pig-fish; "Hogfish."*

Pensacola (Stearns coll., Goode & Bean 1879*a*, as *Pristipoma fulvomaculatum;* Jordan & Gilbert 1882, as *Pomadasys fulvomaculatus;* St. Johns River (A. H. Curtiss coll., Jordan 1880*a*, as *Orthopristis fulvomaculatus;* Jordan & Meek 1884, as *P. chrysopterus*); Florida (Bean 1883, as *O. fulvomaculatus*); Key West and Cedar Keys (Jordan 1884*a*, as *Pomadasys chrysopterus*); Cedar Keys (Jordan & Swain 1884*a*, as *Pomadasys chrysopterus*); Florida Keys (Jordan 1884*d*, as *P. chrysopterus*); Lacosta Island and channel at entrance to Charlotte Harbor (*Grampus* coll., Kendall 1889); Key West and west coast (Henshall 1889); Key West (Henshall 1894); Ozona, Clearwater Harbor, and Key West (Lönnberg 1894, as *Pomadasys fulvomaculatus*); Biscayne Bay (McCormick coll., Smith 1895); Indian River at Eden (Evermann & Bean 1896); and Anclote Sponge Kraals, Tampa Market, and Key West (Evermann & Kendall coll., 1896).

SPARIDÆ. The Porgies.

335. Otrynter caprinus (Bean).

Snapper Banks off Pensacola (Stearns coll., Bean, in Goode & Bean 1882, as *Stenotomus caprinus,* type); Pensacola (Jordan & Gilbert 1882, as *S. caprinus*); Snapper Banks (Stearns coll., Jordan 1884, as *S. caprinus;* and Jordan & Evermann 1898).

336. Stenotomus chrysops (Linnæus). *Scup; Porgy.*

South Carolina to Florida (Holbrook 1860, as *Pagrus argyrops*).

337. Calamus calamus (Cuvier & Valenciennes). *"Saucer-eye Porgy."*

Garden Key (Jordan & Gilbert 1883*b*, as *Calamus macrops*); Key West (Jordan 1884*a*, Henshall 1894, Lönnberg 1894, and Evermann & Kendall coll., 1896); Key West and Florida Keys (Henshall 1889, and Jordan & Evermann 1898); and Biscayne Bay (McCormick coll., Smith 1895).

338. Calamus proridens (Jordan & Gilbert). *Little-head Porgy.*

Key West (Jordan & Gilbert 1884*b*, type; Jordan 1884*a*, as *C. pennatula;* Henshall 1894; Evermann & Kendall coll., 1896; and C. B. Hudson coll., 1897); and Key West and Florida Keys (Henshall 1889).

339. Calamus bajonado (Bloch & Schneider). *Jolt-head Porgy.*

Key West (Poey 1882; Jordan 1884*a*; Henshall 1889 and 1894; Lönnberg 1894; Evermann & Kendall coll., 1896; and C. B. Hudson coll., 1897); Biscayne Bay (McCormick coll., Smith 1895); and Florida Keys (Jordan & Evermann 1898).

340. Calamus penna (Cuvier & Valenciennes). *Little-mouth Porgy; Sheepshead Porgy.*

Pensacola and Charlotte Harbor (C. B. Baker coll., Goode & Bean 1879*a*, type of *Pagellus milneri*); Pensacola (Stearns coll., Bean 1883, as *P. milneri*); Key West (Jordan 1884*a*; Henshall 1894; Lönnberg 1894, as *C. milneri;* Evermann & Kendall coll., 1896; and C. B. Hudson coll., 1897); Lacosta Island (*Grampus* coll., Kendall 1889, as *P. milneri*); and southern Florida and Charlotte Harbor (Jordan & Evermann 1898).

341. Calamus arctifrons Goode & Bean. *"Grass Porgy."*

Pensacola (Stearns coll., Goode & Bean 1882, type); Key West (Jordan 1884*a*, and Henshall 1894); Cedar Keys (Jordan & Swain 1884*a*); Key West and Florida Keys (Henshall 1889); Biscayne Bay (McCormick coll., Smith 1895); Key West and Anclote Sponge Kraals (Evermann & Kendall coll., 1896); and Pensacola and Key West (Jordan & Evermann 1898).

342. Pagrus pagrus (Linnæus). *Red Porgy.*

Pensacola (Stearns coll., Goode & Bean 1879*a*, as *P. argenteus;* Jordan & Gilbert 1882, as *Sparus pagrus;* Stearns coll., Jordan 1884, as *S. pagrus;* and Jordan & Evermann 1898); and Snapper Grounds (*Grampus* coll., Kendall 1889).

343. Lagodon rhomboides (Linnæus). *Pin-fish; Chopa Spina.*

Pensacola (Stearns coll., Goode & Bean 1879*a;* Jordan & Gilbert 1882; and Jordan & Evermann 1898); Charlotte Harbor (Baker coll., Goode & Bean 1879*a*); St. Johns River (Bean 1880); Indian River (Henshall coll., Jordan 1880); St. Johns River (Curtiss coll., Jordan 1880*a*); Key West (Jordan 1884*a*, as *Diplodus rhomboides*); Cedar Keys (Jordan & Swain 1884*a*); Florida Keys (Jordan 1884*d*); Lacosta Island, Gadsden Point, and Snapper Grounds (*Grampus* coll., Kendall 1889); Key West, Marco, Gordon Pass, Big Gasparilla, Myakka River, and San Carlos Pass (Henshall 1889); Tampa and Key West (Henshall 1894); Key West, Ozona, Clearwater Harbor, and other places in Hillsboro County (Lönnberg 1894); Biscayne Bay (McCormick coll., Smith 1895); mouth of Little River, and Lake Worth (Smith coll., 1895); Titusville and Indian River Inlet (Evermann & Bean 1896); Little and Miami rivers, Key West, Anclote Sponge Kraals, Tampa market, and Tarpon Springs (Evermann & Kendall coll., 1896); and Tampa Bay (*Fish Hawk* coll., 1898).

344. Archosargus unimaculatus (Bloch). *Salema.*

Key West (Poey 1882, as *Sargus caribæus;* Jordan 1884*a*, as *Diplodus unimaculatus;* Eigenmann & Hughes 1887; and Jordan & Evermann 1898); and Florida Keys (Jordan 1884*d*).

345. Archosargus probatocephalus (Walbaum). *Sheepshead.*

Massachusetts to Cape Florida (Holbrook 1855*a* and 1860, as *Sargus ovis*); Pensacola (Stearns coll., Goode & Bean 1879*a*, and Jordan & Gilbert 1882, as *Diplodus probatocephalus*); St. Johns River (Bean 1880; Curtis coll., Jordan 1880*a*; Jordan & Meek 1884, as *D. probatocephalus*); Matanzas River Inlet (J. C. Willetts coll., Bean 1883, as *D. probatocephalus*); Key West (Jordan 1884*a*, as *D. probatocephalus*); Cedar Keys (Jordan & Swain 1884*a*, as *D. probatocephalus*); Key West and Florida Keys (Jordan 1884*d*, as *D. probatocephalus*); Punta Rassa (Phillips 1884); Florida Keys (Eigenmann & Hughes 1887, and Jordan & Evermann 1898); Key West and west coast (Henshall 1889); Tampa (Henshall 1894); both coasts, St. Petersburg, Punta Gorda, and New Smyrna (Lönnberg 1894); Biscayne Bay (McCormick coll., Smith 1895); and Cocoa, Titusville, and Indian River Inlet (Evermann & Bean 1896).

346. Diplodus holbrooki (Bean). *"Spot."*

Cedar Keys (Jordan & Swain 1884*a*, and Jordan & Evermann 1898); Pensacola and Cedar Keys (Eigenmann & Hughes 1887); Tampa (Henshall 1894); Indian River (Evermann & Bean 1896); Lake Worth (Evermann & Bean coll., 1896); and Anclote Sponge Kraals (Evermann & Kendall coll., 1896).

347. Diplodus argenteus (Cuvier & Valenciennes). *Sargo.*

New Smyrna (Eigenmann & Hughes 1887; Wm. P. Shannon coll., Jordan & Evermann 1898); and Hillsboro County (Lönnberg 1894, as *D. caudimacula*).

GERRIDÆ. The Mojarras.

348. Eucinostomus dowi (Gill).

Key West, Little River, and Miami River at Miami (Evermann & Kendall coll., 1896).

349. Eucinostomus harengulus Goode & Bean.

West Florida (Stearns coll., Goode & Bean 1879*a*, type); Clearwater Harbor (Velie coll., Goode & Bean 1879*b*, as *Diapterus harengulus*); Key West (Jordan 1884*a*, as *Gerres gracilis*); Barnes Sound, Key West, Lemon Bay and Garden Key (Henshall 1889, as *G. harengulus*); Punta Gorda (Lönnberg 1894, as *G. harengulus*); Biscayne Bay (McCormick coll., Smith 1895); and western Florida and Key West (Jordan & Evermann 1898).

350. Eucinostomus gula (Cuvier & Valenciennes). *Mojarra de Ley.*

Clearwater Harbor (Velie coll., Goode & Bean 1879*b*, type of *Diapterus homonymus*); Cedar Keys (Stearns coll., Bean 1883, as *Gerres homonymus;* and Jordan & Swain 1884*a*, as *G. gula*); Key West (Jordan 1884*a*, and Henshall 1894, as *G. gula*); Florida Keys (Jordan 1884*d*, as *G. gula*); Florida Keys, Barnes Sound, Garden Key, Cape Sable Creek, Big Gasparilla, Key West, Cards Sound, Cape Romano, Marco, Gordon Pass, San Carlos Pass, Long Boat Key, and Egmont Key (Henshall 1889, as *G. gula*); Alligator River (Woolman 1890, as *G. gula*); Captiva Pass (O. P. Hay coll., 1894–95); Biscayne Bay (McCormick coll., Smith 1895); Pelican Island, Indian River Inlet, and Stuart (Evermann & Bean 1896); Cape Florida, Key West, Anclote Sponge Kraals, and Tarpon Springs (Evermann & Kendall coll., 1896); and Tampa Bay (*Fish Hawk* coll., 1898).

351. Ulæma lefroyi (Goode).

Key West (Jordan 1884*a*, as *Gerres lefroyi;* and Evermann & Kendall coll., 1896); Cedar Keys (Jordan and Swain 1884*a*, as *G. lefroyi*); Cedar Keys and Key West (Jordan & Evermann 1898).

352. **Xystæma cinereum** (Walbaum). *"Broad-shad."*

Key West (Jordan 1884*a*, as *Gerres cinereus;* and Henshall 1894, as *G. cinereus*); Florida Keys (Jordan 1884*d*, as *G. cinereus;* and Jordan & Evermann 1898); Cards Sound, Cape Romano, Gordon Pass, Myakka River, and Key West (Henshall 1889, as *G. cinereus*); Biscayne Bay (McCormick coll., Smith 1895); and Lake Worth and Little River (Smith coll., 1895).

353. **Gerres olisthostoma** Goode & Bean. *Irish Pompano; "Mutton-fish."*

Indian River (R. E. Earll coll., Goode & Bean 1882, type; and Bean 1883); Key West (Jordan 1884*a*); Indian River at Fort Pierce (Evermann & Bean 1896); and southern Florida (Jordan & Evermann 1898).

354. **Gerres plumieri** Cuvier & Valenciennes. *Mojarra.*

Indian River (Henshall coll., Jordan 1880); southwest coast of Florida and Punta Gorda (Lönnberg 1894).

KYPHOSIDÆ. The Rudder-Fishes.

355. **Kyphosus sectatrix** (Linnæus). *Rudder-fish; "Chub"; Chopa Blanca.*

Key West (Jordan 1884*a*, as *Cyphosus bosci*); Mullet Key (Henshall 1894); and Key West (Evermann & Kendall coll., 1896).

SCIÆNIDÆ. The Croakers.

356. **Cynoscion nothus** (Holbrook). *Bastard Weak-fish.*

Pensacola (Stearns coll., Goode & Bean 1879*a*); mouth of St. Johns River and St. Augustine (Goode 1879*a*); and Tampa (Henshall 1894).

357. **Cynoscion nebulosus** (Cuvier & Valenciennes). *Spotted Weak-fish.*

Pensacola (Goode & Bean 1879*a*, as *C. carolinensis;* Jordan & Gilbert 1882, as *C. maculatum;* and Jordan & Stearns coll., Bean 1883, as *C. maculatum*); St. Johns River (Bean 1880, as *C. carolinensis;* and Jordan & Meek 1884, as *C. maculatum*); Cedar Keys (Jordan & Swain 1884*a*, as *C. maculatum*); Homosassa River (Wilcox 1886, as *C. maculatum*); west coast (Henshall 1889, as *C. maculatum*); Tampa (Henshall 1894); Biscayne Bay (McCormick coll., Smith 1895, as *C. maculatum*); Titusville, Cocoa, and Indian River Inlet (Evermann & Bean 1896); and Anclote Sponge Kraals (Evermann & Kendall coll., 1896).

358. **Corvula sialis** Jordan & Eigenmann.

Key West (Stearns coll., Jordan & Eigenmann 1886*a*, type), and Florida Keys (Jordan & Eigenmann 1886*a*).

359. **Bairdiella chrysura** (Lacépède).

Pensacola (Stearns coll., Goode & Bean 1879*a*, as *B. argyroleuca;* and Jordan & Gilbert 1882, as *Sciæna punctata*); St. Johns River (Bean 1880, as *B. argyroleuca*); Cedar Keys (Jordan & Swain 1884*a*, as *S. chrysura*); Myakka River and Key West (Henshall 1889); west coast and Clearwater Harbor (Lönnberg 1894); and Anclote Sponge Kraals (Evermann & Kendall coll., 1896).

360. **Stelliferus lanceolatus** (Holbrook).

Matanzas River Inlet (J. C. Willetts coll., Goode 1879*a*, and Bean 1883).

361. **Sciænops ocellatus** (Linnæus). *Red Drum; Channel Bass.*

New York to Cape Florida (Holbrook 1855*a* and 1860, as *Corvina ocellata*); Pensacola (Stearns coll., Goode & Bean 1879*a*; and Jordan & Gilbert 1882, as *Sciæna ocellata*); St. Johns River (Bean 1880, as *S. ocellata;* Jordan & Meek 1884, as *S. ocellata*); Key West (Jordan 1884*a*, as *S. ocellata*); Cedar Keys (Jordan & Swain 1884*a*, as *S. ocellata*); Lacosta Island (*Grampus* coll., Kendall 1889, as *S. ocellata*); Gordon Pass, Myakka River, and west coast (Henshall 1889, as *S. ocellata*); Tampa (Henshall 1894, as *S. ocellata*); both coasts (Lönnberg 1894, as *S. ocellata*); Biscayne Bay (McCormick coll., Smith 1895); Lake Worth (Smith coll., 1895); Indian River Inlet, Pelican Island and Stuart (Evermann & Bean 1896); and Tampa Bay (*Fish Hawk* coll., 1898).

362. Leiostomus xanthurus Lacépède. *Spot.*

East Florida (McClure, Ord, Say & Peale coll., Le Sueur 1821, as *Sciæna multifasciata*); Cape Florida to Rhode Island, and Hatteras to Florida (Holbrook 1855*a*, as *L. obliquus*, and 1860, as *L. obliquus* and *Homoprion xanthurus*); St. Johns River (Bean 1880, as *L. obliquus;* Jordan & Meek 1884); Pensacola (Stearns coll., Goode & Bean 1879*a*, as *L. philadelphicus;* Jordan & Gilbert 1882; and Bean 1883); Cedar Keys (Jordan & Swain 1884*a*); Marco, Gordon Pass, Big Gasparilla, Myakka River, San Carlos Pass, Egmont Key, Long Boat Key (Henshall 1889); Tampa (Henshall 1894); New Smyrna and Punta Gorda (Lönnberg 1894); Biscayne Bay (McCormick coll., Smith 1895); West Palm Beach, Indian River Inlet, and Titusville (Evermann & Bean 1896); and Tarpon Springs and Tampa market (Evermann & Kendall coll., 1896).

363. Micropogon undulatus (Linnæus). *Croaker.*

Pensacola (Stearns coll., Goode & Bean 1879*a*; Jordan & Gilbert 1882; and Stearns coll., Jordan 1884); St. Johns River (Bean 1880; Jordan & Meek 1884); Arlington (Goode coll., Bean 1883); Marco, Gordon Pass (Henshall 1889); Tampa (Henshall 1894); Biscayne Bay (McCormick coll., Smith 1895); Indian River (Evermann & Bean 1896); and Key West (Evermann & Kendall coll., 1896).

364. Umbrina broussonetti Cuvier & Valenciennes.

Indian River (Henshall coll., Jordan 1880, and Jordan & Eigenmann 1886*a*).

365. Menticirrhus americanus (Linnæus). *Whiting.*

Cape Fear to Florida (Holbrook 1855*a* and 1860, as *Umbrina alburnus*); Pensacola (Stearns coll., Goode & Bean 1879*a*, as *M. alburnus;* and Jordan & Gilbert 1882, as *M. nebulosus*); St. Johns River (Jordan & Meek 1884); Marco, Charlotte Harbor, Garden Key, and Egmont Key (Henshall 1889); Punta Gorda (Lönnberg 1894); Biscayne Bay (McCormick coll., Smith 1895); and Indian River at Cocoa (Evermann & Bean 1896).

366. Menticirrhus saxatilis (Bloch & Schneider). *King-fish; Northern Whiting.*

Key West (Jordan 1884*a*); Key West and Pensacola (Jordan & Eigenmann 1886*a*); Tampa (Henshall 1894); Biscayne Bay (McCormick coll., Smith 1895, as *M. nebulosus*).

367. Menticirrhus littoralis (Holbrook). *Silver Whiting.*

Pensacola (Jordan & Gilbert 1882); Florida (Bean 1880); Matanzas River Inlet (J. C. Willetts coll., Bean 1883); Egmont Key (Henshall 1889); Coronado Beach (Lönnberg 1894); and Lake Worth (Smith coll., 1895).

368. Pogonias cromis (Linnæus). *Black Drum; Drum.*

Rhode Island and New York to Cape Florida (Holbrook 1855*a* and 1860, as *P. cromis* and *P. fasciatus*); Pensacola (Stearns coll., Goode & Bean 1879*a*, and Jordan & Gilbert 1882); St. Johns River (Bean 1880; Jordan & Meek 1884); Matanzas River Inlet (J. C. Willetts coll., Bean 1883); Key West (Jordan 1884*a*); Cedar Keys (Jordan & Swain 1884*a*); west coast (Henshall 1889); Tampa (Henshall 1894); Biscayne Bay (McCormick coll., Smith 1895); and Cocoa, Fort Pierce, and Santa Lucia Inlet (Evermann & Bean 1896).

369. Eques acuminatus (Bloch & Schneider).

Tortugas (Jefferson, Porter & Moore 1878, as *Pareques acuminatus*), and Key West (Stearns coll., Bean 1883, as *P. acuminatus*).

370. Eques acuminatus umbrosus Jordan & Eigenmann.

Pensacola (Jordan & Eigenmann 1886*a*, type).

371. Eques lanceolatus (Linnæus). *Ribbon-fish.*

New Smyrna (Lönnberg 1894, as *Sciæna lanceolata*).

POMACENTRIDÆ. The Demoiselles.

372. Chromis insolatus (Cuvier & Valenciennes).

Tortugas (Jefferson, Porter & Moore 1878, as *Heliastes insolatus*); Pensacola (Jordan & Gilbert 1882); Snapper Banks (Stearns coll., Jordan 1884; and Jordan & Evermann 1898).

373. Chromis enchrysurus Jordan & Gilbert.
Pensacola (Jordan & Gilbert 1882, type; and Stearns coll., Bean 1883); Pensacola and Snapper Banks (Jordan 1884); and Snapper Banks off Pensacola and Tampa (Jordan & Evermann 1898).

374. Eupomacentrus fuscus (Cuvier & Valenciennes). *Maria Molle.*
Key West (Evermann & Kendall coll., 1896, and Jordan & Evermann 1898).

375. Eupomacentrus analis (Poey).
Key West (Jordan 1884*a*, as *Pomacentrus obscuratus;* and Jordan & Evermann 1898).

376. Eupomacentrus leucostictus (Müller & Troschel). *"Cock-eye Pilot."*
Tortugas (Jefferson, Porter & Moore 1878, as *Pomacentrus leucostictus*); Clearwater Harbor (Velie coll., Goode & Bean 1879*b*, as *P. leucostictus*); west Florida and Fort Jefferson (Stearns coll., Bean 1883, as *P. leucostictus*); Key West (Jordan 1884*a*, as *P. leucostictus;* and Evermann & Kendall coll., 1896); Pensacola (Stearns coll., Jordan & Swain 1884*f*, as *P. caudalis;* and Jordan & Evermann 1886, as *P. caudalis*); Garden Key (Henshall 1889, as *P. leucostictus*); Tortugas (Garman 1896, as *P. leucostictus*); and Snapper Banks (Jordan & Evermann 1898).

377. Abudefduf saxatilis (Linnæus). *"Cow-pilot."*
Key West (Jordan 1884*a*, as *Glyphidodon saxatilis*); Garden Key (*Grampus* coll., Kendall 1889, as *G. saxatilis*); and Cape Florida and Key West (Evermann & Kendall coll., 1896).

378. Abudefduf declivifrons (Gill).
Marquesas Keys (Jordan 1884*a*, as *Glyphidodon declivifrons*).

379. Nexilarius concolor (Gill).
Marquesas Keys (Velie coll., Goode & Bean 1879*b*, as *Glyphidodon concolor*).

LABRIDÆ. The Wrasse-Fishes.

380. Lachnolaimus maximus (Walbaum). *Hog-fish.*
Key West (Poey 1882, as *L. suillus;* Jordan 1884, as *L. suillus;* Jordan 1887*b;* Henshall 1889 and 1894; Lönnberg 1894, as *L. falcatus;* Evermann & Kendall coll., 1896; C. B. Hudson coll., 1897; and Jordan & Evermann 1898); Florida Keys (Jordan 1884*d*, as *L. suillus*); and Tortugas (Garman 1896).

381. Harpe rufa (Linnæus). *Lady-fish; Pudiano.*
Key West and Florida Keys (Jordan 1884*d*, as *Bodianus rufus*); Key West (Jordan 1887*b;* Lönnberg 1894; C. B. Hudson coll., 1897; and Jordan & Evermann 1898).

382. Decodon pullaris (Poey).
Pensacola Snapper Banks (Stearns coll., Jordan 1884; and Jordan & Evermann 1898); and Pensacola (Jordan & Swain 1884*f*).

383. Iridio radiatus (Linnæus). *Pudding-wife.*
Pensacola (Stearns coll., Bean 1883, as *Platyglossus radiatus*); Fort Jefferson (Whitehurst coll., Bean 1883, as *P. radiatus*); Key West (Jordan 1884*a*, as *P. radiatus;* Henshall 1889 and 1894, as *Halichœres radiatus;* and Evermann & Kendall coll., 1896); and Florida Keys (Jordan 1884*d*, as *P. radiatus;* Jordan & Hughes 1886, as *P. radiatus;* Jordan 1887*b*, as *H. radiatus;* and Jordan & Evermann 1898).

384. Iridio maculipinna (Müller & Troschel).
Key West (Evermann & Kendall coll., 1896).

385. Iridio caudalis (Poey).
Pensacola (Jordan & Gilbert 1882 and 1883, as *Platyglossus caudalis;* Stearns coll., Bean 1883, as *P. caudalis;* and Jordan & Hughes 1886); Snapper Banks and Pensacola (Stearns coll., Jordan 1884, as *P. caudalis*); Snapper Banks off Pensacola (Jordan 1887*b*, as *Halichœres caudalis;* and Jordan & Evermann 1898).

386. Iridio bivittatus (Bloch). *Slippery Dick; Doncella.*
Clearwater Harbor (Velie coll., Goode & Bean 1879*b*, as *Chœrojulis humeralis*); Pensacola (Jordan & Gilbert 1882, as *Platyglossus florealis*, type; Jordan & Gilbert 1883); Key West (Jordan 1884*a*, as *P. bivittatus*); Snapper Banks (Stearns coll., Jordan 1884,

as *P. bivittatus*); Florida Keys (Jordan 1884*d*, as *P. bivittatus*); Key West, Big Gasparilla, Lemon Bay, and Garden Key (Henshall 1889, as *Halichœres bivittatus*); Tortugas (Garman 1896, as *P. bivittatus*); Key West and Cape Florida (Evermann & Kendall coll., 1896); and Pensacola and Key West (Jordan & Evermann 1898).

387. **Doratonotus megalepis** Günther.

Key West (Jordan & Gilbert 1884*a*, type of *D. thalassinus;* Jordan 1884*a*, as *D. thalassinus;* and Jordan & Evermann 1898); and Garden Key (Henshall 1889).

388. **Xyrula jessiæ** (Jordan).

Off Tampa Bay (Bollman coll., Jordan 1887*a*, type of *Xyrichthys jessiœ;* and Jordan 1887*b*); and Snapper Banks off Tampa Bay (Jordan & Evermann 1898).

389. **Novaculichthys rosipes** (Jordan & Gilbert).

Key West (Jordan & Gilbert 1884*a*, type of *Xyrichthys rosipes;* Jordan 1884*a* and 1887*b*, as *X. rosipes;* and Jordan & Evermann 1898).

390. **Xyrichthys psittacus** (Linnæus). *Razor-fish.*

Pensacola (Jordan & Gilbert 1883, as *X. lineatus;* Jordan 1887*b*, as *X. novacula;* and Jordan & Evermann 1898); west Florida and Pensacola (Stearns coll., Bean 1883, as *X. lineatus*); Garden Key and Florida Keys (Whitehurst coll., Bean 1883, as *X. lineatus*); Key West (Jordan 1884*a*); Snapper Banks (Stearns coll., Jordan 1884, as *X. lineatus*); and off Pensacola (*Fish Hawk* coll., 1895).

SCARIDÆ. The Parrot-Fishes.

391. **Cryptotomus retractus** (Poey).

North to Pensacola (Jordan 1887*b*).

392. **Cryptotomus ustus** (Cuvier & Valenciennes).

North to Pensacola (Jordan 1887*b*); Indian River Inlet (Evermann & Bean 1896).

393. **Cryptotomus beryllinus** Jordan & Swain.

Key West (Jordan & Swain 1884, type; Jordan 1884*a* and 1887*b*; and Jordan & Evermann 1898); and Cape Florida (Evermann & Kendall coll., 1896).

394. **Sparisoma xystrodon** Jordan & Swain.

Key West (Jordan & Swain 1884, type; Jordan 1884*a* and Jordan & Evermann 1898); Florida Keys (Jordan 1887*b*); and Cape Florida and Key West (Evermann & Kendall coll., 1896).

395. **Sparisoma hoplomystax** (Cope).

Key West (Jordan & Swain 1884, as *S. cyanolene*, type, and Jordan 1884*a*; Henshall 1889; and Jordan & Evermann 1898); Florida Keys (Jordan 1887*b*); and Key West and Cape Florida (Evermann & Kendall coll., 1896).

396. **Sparisoma niphobles** Jordan & Bollman.

Key West and Cape Florida (Evermann & Kendall coll., 1896).

397. **Sparisoma distinctum** (Poey).

Garden Key (Henshall 1889).

398. **Sparisoma flavescens** (Bloch & Schneider). *Viejo Colorado.*

Florida Keys and Garden Key (Bean 1883, as *Scarus squalidus*); Key West (Jordan & Swain 1884; Jordan 1884*a* and 1887*b*; and Henshall 1889 and 1894); and Cape Florida and Key West (Evermann & Kendall coll., 1896).

399. **Scarus bollmani** Jordan & Evermann.

Snapper Banks off Tampa Bay (Jordan & Evermann 1886, type), and off Tampa Bay (Jordan 1887*b*, and Jordan & Evermann 1898).

400. **Scarus croicensis** (Bloch). *Bullon.*

Key West (Jordan & Swain 1884, Jordan 1884*a*, 1884*d*, and 1887*b*; and Evermann & Kendall coll., 1896).

401. **Scarus evermanni** Jordan.

Snapper Banks (Jordan in Jordan & Evermann, 1886, type), and Gulf of Mexico off Tampa Bay (Jordan & Evermann 1898).

402. Scarus cœruleus (Bloch). *Blue Parrot-fish.*
Key West (Jordan & Swain 1884, Jordan 1884*a*, Henshall 1894, and Jordan & Evermann 1898); Florida Keys (Jordan 1884*d*); north to Key West (Jordan 1887*b*); and Tortugas (Garman 1896, as *Pseudoscarus cœruleus*).

403. Pseudocarus guacamaia (Cuvier). *Green Parrot-fish.*
Key West (Jordan & Swain 1884, as *Scarus guacamaia;* Jordan 1884*a*, as *S. guacamaia;* Henshall 1894, as *S. guacamaia;* Evermann & Kendall coll., 1896; and Jordan & Evermann 1898); and Florida Keys (Jordan 1884*d*, as *S. guacamaia*).

EPHIPPIDÆ. The Angel-Fishes.

404. Chætodipterus faber (Broussonet). *Angel-fish; Spade-fish.*
Pensacola (Stearns coll., Goode & Bean 1879*a*, as *Paraphippus faber;* and Bean 1883); Key West (Jordan 1884*a*, and Evermann & Kendall coll., 1896); Egmont Key (Jordan 1884*e*); Gadsden Point (*Grampus* coll., Kendall 1889); west coast (Henshall 1889); Tampa (Henshall 1894); Clearwater Harbor (Lönnberg 1894); Biscayne Bay (McCormick coll., Smith 1895); and Fort Pierce and Eden (Evermann & Bean 1896).

CHÆTODONTIDÆ. The Butterfly-Fishes.

405. Chætodon ocellatus Bloch. *Parche; Isabelita de lo Alto; Mariposa.*
Key West and Florida Keys (Jordan 1884*a*); Key West (Evermann & Kendall coll., 1896, and C. B. Hudson coll., 1897).

406. Chætodon aya Jordan. *Mariposa.*
Snapper Banks near Pensacola (Jordan 1886, type); Pensacola (Eigenmann & Horning 1897); and Snapper Banks (Jordan & Evermann 1898).

407. Chætodon capistratus Linnæus. *Parche; Mariposa.*
Florida and Fort Jefferson (Bean 1883), and Key West (Jordan 1884*a*).

408. Pomacanthus arcuatus (Linnæus). *"Black Angel."*
Garden Key (Whitehurst coll., Bean 1883); Key West (Jordan 1884*a*, as *P. aureus;* Henshall 1894, as *P. aureus;* and Evermann & Kendall coll., 1896); Florida Keys (Jordan 1884*d*, as *P. aureus*); and Tortugas (Garman 1896).

409. Pomacanthus paru (Bloch). *Paru; "French Angel."*
Key West (Evermann & Kendall coll., 1896).

410. Angelichthys isabelita Jordan & Rutter. *Angel-fish.*
Key West (Jordan & Rutter, in Jordan & Evermann 1898, type).

411. Angelichthys ciliaris (Linnæus). *"Yellow Angel."*
Key West (Jordan 1884*a*, as *Holacanthus ciliaris;* and Eigenmann & Horning 1887, as *Pomacanthus ciliaris*); and Florida Keys (Jordan 1884*d*, as *H. ciliaris*); Tortugas (Garman 1896, as *Holacanthus ciliaris*).

TEUTHIIDÆ. The Surgeons.

412. Teuthis cœruleus (Bloch & Schneider). *"Blue Tang"; Barbero; Medico.*
Tortugas (Jefferson, Porter & Moore 1878, as *Acanthurus nigricans*); Florida Keys (Jordan 1884*d*, as *A. cœruleus*); Key West (Henshall 1894; Evermann & Kendall coll., 1896; and Jordan & Evermann 1898).

413. Teuthis hepatus Linnæus. *"Tang"; Doctor-fish; Medico; Barbero.*
Garden Key (Bean 1883, as *Acanthurus chirurgus*); Key West (Jordan 1884*a*, as *A. chirurgus;* Henshall 1894; Evermann & Kendall coll., 1896; and Jordan & Evermann 1898).

414. Teuthis bahianus (Castelnau). *"Ocean Tang"; Barbero; Medico.*
Key West (Jordan 1884*a*, as *Acanthurus tractus;* Evermann & Kendall coll., 1896; and Jordan & Evermann 1898); and Florida Keys (Jordan 1884*d*, as *A. chirurgus tractus*).

BALISTIDÆ. The Trigger-Fishes.

415. Balistes carolinensis Gmelin. *Leather Jacket; Trigger-fish.*

Pensacola (Stearns coll., Goode & Bean 1879*a*, as *B. capriscus;* Jordan & Gilbert 1882, as *B. capriscus;* and Stearns coll., Jordan 1884); Charlotte Harbor (Bean 1883, as *B. capriscus*); Key West (Jordan 1884*a;* Henshall 1894; Lönnberg 1894, as *B. capriscus*); Florida Keys (Jordan 1884*d*); Egmont Key (Jordan 1884*e*); and west coast and Key West (Henshall 1889).

416. Balistes vetula Linnæus. *Bessy Cerka.*

Key West (Henshall 1894; Lönnberg 1894; and C. B. Hudson coll., 1897).

MONACANTHIDÆ. The File-Fishes.

417. Cantherines pullus (Ranzani). *Lija Colorada.*

Tortugas (Jefferson, Porter & Moore 1878, as *Monacanthus pardalis*); and southern Florida (Jordan & Evermann 1898).

418. Monacanthus ciliatus (Mitchill). *Leather-fish.*

Florida Reef (Geo. Davidson coll., Cope 1871); Pensacola, Cedar Key, and Charlotte Harbor (Stearns and Baker coll., Goode & Bean 1879*a*, as *M. occidentalis*); Key West (Velie coll., Goode & Bean 1879*b*, as *M. occidentalis*); Florida Keys and Indian Key (Würdemann coll., Bean 1883, as *M. occidentalis*); Key West (Jordan 1884*a*); Big Gasparilla and Garden Key (Henshall 1889); Key West (Henshall 1894); Key West and Miami (Evermann & Kendall coll., 1896); Florida Keys (Jordan 1884*d*, and Jordan & Evermann 1898).

419. Monacanthus hispidus (Linnæus). *Fool-fish.*

Key West (Jordan 1884*a*, and Henshall 1894); Florida Keys (Jordan 1884*d*, and Jordan & Evermann 1898); Snapper Grounds (*Grampus* coll., Kendall 1889); Big Gasparilla and Key West (Henshall 1889); Key West and Ozona (Lönnberg 1894); Key West, Anclote Sponge Kraals, and Miami (Evermann & Kendall coll , 1896).

420. Alutera schœpfii (Walbaum). *Fool-fish; Lija.*

Tortugas (Jefferson, Porter & Moore 1878, as *Ceratacanthus aurantiacus*); Pensacola (Stearns coll., Goode & Bean 1879*a;* and Stearns coll., Jordan 1884); Egmont Key (Jordan 1884*e*); Key West and Tampa (Henshall 1894); and Key West (Evermann & Kendall coll., 1896; and C. B. Hudson coll., 1897).

OSTRACIIDÆ. The Trunk-Fishes.

421. Lactophrys triqueter (Linnæus). *Trunk-fish; Shell-fish.*

Tortugas (Goode 1879, as *Ostracion triqueter*); Garden Key (Whitehurst coll., Bean 1883, as *Ostracion triquetrum*); Key West (Jordan 1884*a*, as *Ostracion triquetrum*); Cape Florida (Evermann & Kendall coll., 1896); and Key West and Pensacola (Jordan & Evermann 1898).

422. Lactophrys trigonus (Linnæus). *Trunk-fish; Shell-fish.*

Tortugas (Goode 1879, as *Ostracion trigonus;* and J. B. Holder coll., Bean 1883, as *Ostracium trigonum*); west coast (Velie coll., Goode & Bean 1879*b*, as *Ostracion trigonus;* and Henshall 1889); St. Augustine and Matanzas (Goode 1879*a*, as *O. trigonus*); Florida Keys (Jordan 1884*d*, as *O. trigonum*); Key West (Jordan 1884*a*, as *O. trigonum*); Henshall 1894, as *O. trigonum;* Evermann & Kendall coll., 1896; and Jordan & Evermann 1898); Bird Key (*Grampus* coll., Kendall 1889, as *O. trigonum*); Biscayne Bay (McCormick coll., Smith 1895); and Tampa Bay (*Fish Hawk* coll., 1898).

423. Lactophrys tricornis (Linnæus). *Cow-fish.*

Tortugas (Jefferson, Porter & Moore 1878, as *Ostracium quadricorne*); Tortugas, Cape Florida, Charlotte Harbor, and Pensacola (Goode 1879, as *O. quadricornis*); Pensacola (Stearns coll., Goode & Bean 1879*a*, as *O. quadricornis*); Jordan & Gilbert 1882, as *Ostracium quadricorne;* and Jordan & Evermann 1898); Key West (Jordan 1884*a*, as *Ostracion tricorne*); Florida Keys (Jordan 1884*d*, as *Ostracium tricorne*); Gulf shore (Wilcox 1886, as *Ostracion quadricornis*); Snapper Grounds (*Grampus* coll., Kendall 1889, as *O. quadricornis*); west coast (Henshall 1889, as *O. tricorne*); Tampa (Henshall 1894, as *O. tricorne*); along west coast, Clearwater Harbor, Key West and New Smyrna (Lönnberg 1894, as *O. quadricorne*); Key West and Tarpon Springs (Evermann & Kendall coll., 1896); and Tampa Bay (*Fish Hawk* coll., 1898).

TETRAODONTIDÆ. The Puffers.

424. Lagocephalus lævigatus (Linnæus). *Rabbit-fish.*

Tortugas (Jefferson, Porter & Moore 1878, as *Tetrodon lævigatus*); mouth of St. Johns River (Goode 1879*b*); Pensacola (Stearns coll., Goode & Bean 1879*a*); Florida Keys and west coast (Henshall 1889); Biscayne Bay (McCormick coll., Smith 1895); and Key West (C. B. Hudson coll., 1897).

425. Spheroides spengleri (Bloch). *Southern Puffer.*

Tortugas (Cope 1871, as *Tetrodon spengleri*); Key West (Jordan 1884*a*, as *T. nephelus*, in part; Jordan coll., U. S. Nat. Mus., No. 35188, as *T. nephelus*, in part; L. A. Beardslee coll., U. S. Nat. Mus. No. 38342, as *T. nephelus;* and Evermann & Kendall coll., 1896); Garden Key (U. S. Nat. Mus., as *T. nephelus*, in part); Biscayne Bay (McCormick coll., Smith 1895); Key West and Big Gasparilla (Henshall 1899); and Tampa (Henshall 1894).

426. Spheroides maculatus (Bloch & Schneider). *Puffer.*

Mouth of St. Johns River (Goode 1879*a*, as *Cirrisomus turgidus*); Pensacola (Stearns coll., Goode & Bean 1879*a*, as *C. turgidus;* and Jordan & Gilbert 1882, as *Tetrodon turgidus*); North Florida (Jordan & Edwards 1886); Big Estero Pass (Henshall 1889); Ozona and Clearwater Harbor (Lönnberg 1894, as *T. turgidus*); and Indian River at Cocoa (Evermann & Bean 1896, as *S. testudineus*).

427. Spheroides nephelus (Goode & Bean). *Swell Toad.*

Indian River and Pensacola (Earll & Stearns coll., Goode & Bean 1882, type of *Tetrodon nephelus*); Pensacola (Jordan & Gilbert 1882, as *T. turgidus nephelus*); Key West (Wm. Stimpson coll., Bean 1883, as *T. nephelus;* Jordan 1884*a*, as *T. nephelus*, in part; and Jordan & Edwards 1886, in part, as *S. spengleri*); Florida Keys (Jordan 1884*d*, as *T. nephelus*); Charlotte Harbor (*Grampus* coll., Kendall 1889, as *T. testudineus*); mouth of St. Lucie River at Stuart, and Indian River at Cocoa (Evermann & Bean 1896, as *S. spengleri*); Anclote Sponge Kraals (Evermann & Kendall coll., 1896); and Tampa Bay (*Fish Hawk* coll., 1898).

428. Spheroides testudineus (Linnæus). *Tambor; Blow-fish.*

Tortugas (Jefferson, Porter & Moore 1878, as *Chilichthys testudineus*); Indian River (Würdemann coll., Bean 1883, as *Tetrodon testudineus*); south Florida (Cooper coll., U. S. Nat. Mus. No. 2138, as *T. testudineus*); Key West (Jordan coll., U. S. Nat. Mus. No. 35077, as *T. testudineus*); and Lönnberg 1894, as *T. testudineus*); Lake Worth and Little River (Smith coll., 1895); and St. Lucie River at Stuart (Evermann & Bean 1896).

CANTHIGASTERIDÆ. The Sharp-nosed Puffers.

429. Canthigaster rostratus (Bloch).

Pensacola (Jordan & Edwards 1886, and Jordan & Evermann 1898).

430. Diodon hystrix Linnæus. *Porcupine-fish.*

Tortugas (Jordan 1884*a*); Florida Keys, Key West, and Tortugas (Henshall 1889); Key West (Henshall 1894); Biscayne Bay (McCormick coll., Smith 1895); and Indian River at Cocoa (Evermann & Bean 1896).

431. Diodon holacanthus Linnæus.

Garden Key (Bean 1883, as *D. liturosus*); Egmont Key (Jordan 1884*e*, as *D. liturosus*); and Florida Keys (Jordan & Evermann 1898).

432. Chilomycterus schœpfi (Walbaum). *Burr-fish.*

Pensacola (Goode & Bean 1879*a*, as *C. geometricus;* and Stearns coll., Bean 1883, as *C. geometricus*); mouth of St. Johns River, and Indian River (Goode 1879*a*, as *C. geometricus*); Key West (Velie coll., Goode & Bean 1879*b*, as *C. geometricus;* and Jordan 1884*a*, as *C. geometricus*); Indian River (Henshall coll., Jordan 1880, as *C. geometricus*); Gulf shore (Wilcox 1886, as *Diodon maculato-striatus*); Egmont Key (Henshall 1889);

Tampa (Henshall 1894); Key West, St. Augustine and New Smyrna (Lönnberg 1894, as *C. geometricus*); Biscayne Bay (McCormick coll., Smith 1895); Cocoa (Evermann & Bean 1896); Key West and Anclote Sponge Kraals (Evermann & Kendall coll., 1896); and Tampa Bay (*Fish Hawk* coll., 1898).

433. **Chilomycterus atinga** (Linnæus). *Atinga.*
Florida Keys (Jordan 1884*a*, as *C. reticulatus;* and Jordan & Evermann 1898).

434. **Lyosphæra globosa** Evermann & Kendall.
Biscayne Bay (Evermann & Kendall 1897, type of genus and species).

MOLIDÆ. The Head-Fishes.

435. **Mola mola** (Linnæus). *Sun-fish.*
Mouth of St. Johns River (Goode 1879*a*, as *M. rotunda*); off St. Augustine, specimen in curio shop at St. Augustine (seen by Evermann & Bean 1896).

SCORPÆNIDÆ. The Rock-Fishes.

436. **Helicolenus dactylopterus** (De la Roche). *Cardonniera.*
In 105 fathoms, 6 miles S. ½ E. off Sand Key light (Garman 1896, as *Scorpæna dactyloptera*).

437. **Helicolenus maderensis** Goode & Bean. *Boca Negra.*
Lat. 28° 42′ N., long. 86° 36′ W., in 280 fathoms, southward of Pensacola (Goode & Bean 1896).

438. **Scorpæna brasiliensis** Cuvier & Valenciennes.
Pensacola (Goode & Bean 1882, type of *S. stearnsii;* and Jordan & Evermann 1898); Florida Keys (Jordan 1884*d*, as *S. stearnsi*); Key West (Jordan 1884*a*, as *S. stearnsi*); Pensacola and Snapper Banks (Stearns coll., Jordan 1884, as *S. stearnsi*); Egmont Key (Jordan 1884*e*, as *S. stearnsii*); Boca Grande (*Fish Hawk* coll., 1889); Fort Pierce and Indian River Inlet (Evermann & Bean 1896); and Key West and Miami (Evermann & Kendall coll., 1896).

439. **Scorpæna plumieri** Bloch. *Rascacio.*
Clearwater Harbor (Velie coll., Goode & Bean 1879*b*, as *Scorpæna*, sp.); Fort Jefferson (Bean 1883); Key West (Jordan 1884*a*; Henshall 1894; and C. B. Hudson coll., 1897); Florida Keys (Jordan 1884*d*); and off Key West in 60 fathoms (Garman 1896).

440. **Scorpæna grandicornis** Cuvier & Valenciennes. *Lion-fish.*
Key West (Jordan 1884*a*; Henshall 1889 and 1894); and Florida Keys (Jordan 1884*d*, and Jordan & Evermann 1898).

441. **Scorpæna inermis** Cuvier & Valenciennes.
Clearwater Harbor (Goode & Bean 1882, type of *S. calcarata;* and Jordan & Evermann 1898); and Pensacola (Jordan & Evermann 1886, as *S. occipitalis*).

442. **Pontinus longispinis** Goode & Bean.
Lat. 28° 36′ N., long. 85° 33′ 30″ W., in 111 fathoms, southward of Pensacola (Goode & Bean 1896, type).

443. **Setarches parmatus** Goode.
Lat. 28° 42′ N., long. 86° 36′ W., in 280 fathoms, off southward between Pensacola and Cape San Blas (Goode & Bean 1896).

TRIGLIDÆ. The Gurnards.

444. **Prionotus scitulus** Jordan & Gilbert.
Mouth of St. Johns River or east coast (Goode 1879*a*, as *P. punctatus*).

445. **Prionotus roseus** Jordan & Evermann.
Clearwater Harbor (Velie coll., Goode & Bean 1879*b*, as *P. punctatus*); Pensacola (Jordan & Gilbert 1882, as *P. scitulus*); Lacosta Island (*Grampus* coll., Kendall 1889, as *P. scitulus*); Cape Romano and Big Gasparilla (Henshall 1889, as *P. scitulus*); Snapper Banks (Jordan & Evermann 1886, type); Tampa Bay and Pensacola (Jordan & Evermann 1898); and Tampa Bay (*Fish Hawk* coll., 1898).

446. Prionotus alatus Goode & Bean.

Lat. 28° 42′ 30″ N., long. 85° 29′ W., in 88 fathoms, southward of Cape St. George, and lat. 28° 44′ N., long. 85° 16′ W., in 60 fathoms, southward of Cape St. George (Goode & Bean 1896).

447. Prionotus ophryas Jordan & Swain.

Snapper Banks off Pensacola (Stearns coll., Jordan & Swain 1884*f*, type); and Snapper Banks (Jordan & Evermann 1898).

448. Prionotus stearnsi Jordan & Swain.

Snapper Banks off Pensacola (Jordan & Swain 1884*f*, type); Pensacola, from stomach of red grouper; lat. 28° 45′ N., long. 82° 2′ W., in 30 fathoms, southward of Cape St. George; and lat. 28° 41′ N., long. 86° 7′ W., in 109 fathoms, southward from between Pensacola and Cape San Blas (Goode & Bean 1896).

449. Prionotus evolans (Linnæus). *Striped Gurnard.*

Indian River at Cocoa (Evermann & Bean 1896).

450. Prionotus tribulus Cuvier & Valenciennes. *Big-headed Gurnard.*

St. Augustine (Goode 1879*a*); Pensacola (Stearns coll., Goode & Bean 1879*a*; and Bean 1883); Cedar Keys (Jordan & Swain 1884*a*); Cape Romano, Gordon Pass, Big Gasparilla, and San Carlos Pass (Henshall 1889); Tortugas (C. C. Nutting coll., Garman 1896); Indian River Inlet (Evermann & Bean 1896); and Pensacola and Cedar Keys (Jordan & Evermann 1898).

451. Bellator militaris (Goode & Bean).

Lat. 28° 44′ N., long. 85° 16′ W., in 60 fathoms, southward of Cape San Blas, (Goode & Bean 1896, type of *Prionotus militaris*); lat. 28° 46′ N., long. 84° 49′ W., in 26 fathoms, southward from Cape St. George; and lat. 28° 47′ 30″ N., long. 84° 37′ W., in 24 fathoms, southward from Cape St. George (*Albatross* coll., Goode & Bean 1896, cotypes).

PERISTEDIIDÆ. The Deep-water Gurnards.

452. Peristedion gracile Goode & Bean.

Lat. 28° 38′ 30″ N., long. 85° 52′ 30″ W., in 142 fathoms (*Albatross* coll., Goode & Bean 1896, type).

453. Vulsiculus imberbis (Poey).

Pensacola and Snapper Grounds (Stearns coll., Jordan 1884, as *Peristedium imberbe*); and Snapper Banks (Jordan & Evermann 1898).

CEPHALACANTHIDÆ. The Flying Robins.

454. Cephalacanthus volitans (Linnæus). *Flying Robin.*

Tortugas (Jefferson, Porter & Moore 1878, as *Dactylopterus volitans*); St. Augustine, mouth of St. Johns River (Goode 1879*a*, as *D. volitans*); and Pensacola (Stearns coll., Goode & Bean 1879*a*, as *D. volitans*).

CALLIONYMIDÆ. The Dragonets.

455. Callionymus bairdi Jordan.

Snapper Banks (Stearns coll., Jordan 1887, type); and Snapper Banks between Pensacola and Tampa (Jordan & Evermann 1898).

456. Callionymus agassizii Goode & Bean.

Lat. 24° 17′ 30″ N., long. 82° 9′ W., in 137 fathoms, southward of Marquesas Keys; lat. 28° 44′ N., long. 85° 16′ W., in 60 fathoms, southward of Cape San Blas; lat. 28° 36′ N., long. 85° 33′ 30″ W., in 111 fathoms, southward of Cape St. George (Goode & Bean 1896, as *C. himantophorus*.)

457. Callionymus calliurus Eigenmann & Eigenmann.

Off South Beach, Key West (Eigenmann & Eigenmann 1888, type), and Cape Florida (Evermann & Kendall coll., 1896).

GOBIIDÆ. The Gobies.

458. **Ioglossus calliurus** Bean.

Pensacola (Bean, in Jordan & Gilbert 1882, type of genus and species; Goode & Bean 1882; Stearns coll., Bean 1883); Pensacola and Snapper Banks (Stearns coll., Jordan 1884); Snapper Banks off Pensacola (Jordan & Evermann 1898).

459. **Dormitator maculatus** (Bloch). *Guavina; Mapo; Paneca.*

Snapper Grounds, in 37 fathoms (*Grampus* coll., Kendall 1889, as *Dormitator*, sp.); Hillsboro River (Smith coll., 1895); and Indian River Inlet (Evermann & Bean coll., 1896).

460. **Eleotris amblyopsis** (Cope).

Pensacola (Stearns coll., Bean 1883, as *Culius amblyopsis*).

461. **Eleotris pisonis** (Gmelin). *Sleeper.*

Pensacola (Stearns coll., Goode & Bean 1879*a*, as *E. gyrinus*).

462. **Erotelis smaragdus** (Cuvier & Valenciennes). *Esmeralda Negra.*

Key West (Jordan 1884*a*, as *Eleotris smaragdus*; Eigenmann & Eigenmann 1888; and Jordan & Evermann 1898).

463. **Lophogobius cyprinoides** (Pallas).

Crocodile Hole and Indian Creek (Smith coll., 1895), and Little River at Miami (Evermann & Kendall 1897).

464. **Gobius soporator** Cuvier & Valenciennes. *Sleeper; Mapo.*

Pensacola (Stearns coll., Goode & Bean 1879*a*; Jordan & Gilbert 1882; and Stearns coll., Bean 1883 and Jordan 1884); Arlington (Goode 1879*a*, as *G. carolinensis*); Key West (Jordan 1884*a*, Lönnberg 1894, and Evermann & Kendall coll., 1896); Tortugas and Florida Keys (Eigenmann & Eigenmann 1888); Myakka River, Marco (Henshall 1889); and Indian River Inlet (Evermann & Bean 1896).

465. **Gobius eigenmanni** Garman.

Off Key West in 60 fathoms (Garman 1896).

466. **Gobius glaucofrænum** (Gill).

Tortugas (Eigenmann & Eigenmann 1888), and Florida Keys (Jordan & Evermann 1898).

467. **Gobius stigmaturus** Goode & Bean.

Florida Keys (?) (Goode & Bean 1882, type, and Jordan & Evermann 1898); Key West (Jordan 1884*a*, and Eigenmann & Eigenmann 1888); Cards Sound (Henshall 1889); and Indian River Inlet (Evermann & Bean coll., 1896).

468. **Gobius boleosoma** Jordan & Gilbert.

Laguna Grande, at Pensacola (Jordan & Gilbert 1882, type); Pensacola (Jordan & Stearns coll., Bean 1883); Indian River Inlet (Evermann & Bean 1896); and Pensacola to Key West (Jordan & Evermann 1898).

469. **Gobius encæomus** Jordan & Gilbert.

Key West (Jordan 1884*a*, and Jordan & Evermann 1898).

470. **Gobius stigmaticus** (Poey).

Indian River Inlet (Evermann & Bean 1896), and Florida Keys (Jordan & Evermann 1898).

471. **Gobius lyricus** Girard.

Indian River Inlet (Evermann & Bean 1896).

472. **Gobius smaragdus** Cuvier & Valenciennes. *Esmeralda.*

Gordon Pass, Marco and St. Augustine (Henshall 1889); St. Augustine (Hay coll., Jordan & Evermann 1898).

473. **Gobius hastatus** (Girard). *Emerald-fish; Sharp-tailed Goby.*

Key West (Jordan coll., No. 35158 U. S. Nat. Mus.).

474. Microgobius gulosus (Girard).

Pensacola (Jordan & Gilbert 1882, as *Lepidogobius gulosus*); Cards Sound, Marco, Gordon Pass, Big Gasparilla, Myakka River, Lemon Bay, Long Boat Key (Henshall 1889); Captiva Pass (O. P. Hay coll., 1894–95); Little River and Lake Worth (Smith coll., 1895); Cocoa, Titusville, Pelican Island, South Lake, and Indian River Inlet (Evermann & Bean 1896); Anclote Sponge Kraals and Lake Butler (Evermann & Kendall coll., 1896); Palatka and Welaka in St. Johns River, and Lake Monroe (Kendall coll., 1897); Indian River and Pensacola (Jordan & Evermann 1898); and Tampa Bay (*Fish Hawk* coll., 1898).

475. Microgobius thalassinus Jordan & Gilbert.

Marco Inlet (Henshall 1889).

476. Gobiosoma molestum Girard.

Pensacola (Jordan & Gilbert 1882, as *G. alepidotum*, and Eigenmann & Eigenmann 1888); Cards Sound, Marco. Gordon Pass, Big Gasparilla, Myakka River, and Lemon Bay (Henshall 1889); and Key West (Jordan & Evermann 1898).

477. Gobiosoma bosci (Lacépède).

St. Johns River (A. H. Curtis coll., Jordan 1880*a*, as *G. alepidotum*); Pensacola (Stearns coll., Bean 1883, as *G. boscii*); Key West (Jordan 1884*a*); Amelia Island (Eigenmann & Eigenmann 1888); Captiva Pass (O. P. Hay coll., 1894–95); Lake Worth (Smith coll., 1895); Indian River Inlet, Pelican Island, Titusville, and Cocoa (Evermann & Bean 1896); and St. Johns River at Palatka and Welaka (Kendall coll., 1897).

478. Barbulifer ceuthœcus (Jordan & Gilbert).

Key West (Jordan & Gilbert 1884*a*, type of *Gobiosoma ceuthœcum;* Jordan 1884*a*, as *G. ceuthœcum;* and Jordan & Evermann 1898).

ECHENEIDIDÆ. The Remoras.

479. Echeneis naucrates Linnæus. *Shark-sucker.*

Massachusetts to Florida (Holbrook 1855*a*, as *E. albicauda*); Carolina to Florida (Holbrook 1860, as *E. lineata*); mouth of St. Johns River (Goode 1879*a*); Indian River (Jordan 1880); Pensacola (Jordan & Gilbert 1882, and Stearns coll., Jordan 1884); Big Sarasota Bay (Bean 1883); Key West (Jordan 1884*a*; Henshall 1894; Lönnberg 1894; Evermann & Kendall coll., 1896; and Jordan & Evermann 1898); Charlotte Harbor (*Fish Hawk* coll., 1889); Lemon Bay, Sarasota Bay and Garden Key (Henshall 1889); and Tortugas (Garman 1896).

480. Echeneis naucrateoides Zuieuw. *Shark-sucker.*

Pensacola (Goode & Bean 1879*a*), and Key West (Jordan & Evermann 1898).

481. Remora remora (Linnæus). *Remora.*

Indian River at Cocoa (Evermann & Bean 1896).

MALACANTHIDÆ. The Blanquillos.

482. Caulolatilus microps Goode & Bean.

Snapper Banks off Pensacola (Goode & Bean 1878, type, and Jordan & Evermann 1898), and Pensacola (Stearns coll., Goode & Bean 1879*a*, and Jordan 1884).

OPISTHOGNATHIDÆ. The Jaw-Fishes.

483. Opisthognathus lonchurum Jordan & Gilbert.

Snapper Banks off Pensacola (Jordan & Gilbert 1882, type of *O. lonchurus;* Stearns coll., Jordan 1884, as *O. lonchura;* and Jordan & Evermann 1898).

484. Opisthognathus macrognathum Poey.

Garden Key (Whitehurst coll., Goode & Bean 1882, as *O. scaphiurus*, type); Pensacola (Stearns coll., Bean 1883); Tortugas (Jordan 1884*a*, as *O. scaphiurus*); and Florida Keys (Jordan & Evermann 1898).

485. Gnathypops maxillosa (Poey).

Garden Key (Bean 1883, as *Opisthognathus maxillosus*), and Florida (Jordan & Evermann 1898).

486. Gnathypops mystacina Jordan.

Pensacola Snapper Banks (Stearns coll., Jordan 1884, type; and Jordan & Evermann 1898).

CHÆNICHTHYIDÆ.

487. Hypsicometes gobioides Goode.

Lat. 28° 36′ N., long. 85° 33′ 30″ W., in 111 fathoms, southward of Cape San Blas; lat. 28° 45′ N., long. 86° 26′ W., in 22 fathoms; lat. 28° 42′ 30″ N., long. 85° 29′ W., in 88 fathoms, southward of Cape San Blas; and lat. 28° 44′ N., long. 86° 18′ W., in 196 fathoms, southward between Pensacola and Cape San Blas (*Albatross* coll., Goode & Bean 1896).

DACTYLOSCOPIDÆ. The Sand Star-Gazers.

488. Gillellus semicinctus Gilbert.

Snapper Banks, in 31 and 16½ fathoms (*Grampus* coll., Kendall 1889).

489. Dactyloscopus tridigitatus Gill.

Key West (Jordan 1884*a*, Henshall 1889, and Jordan & Evermann 1898); Pensacola (Jordan & Evermann 1886); and Cape Florida (Evermann & Kendall coll., 1896).

URANOSCOPIDÆ. The Star-Gazers.

490. Astroscopus y-graecum (Cuvier & Valenciennes). *Star-gazer.*

New Berlin and St. Augustine (Goode 1879*a*, as *Uranoscopus y-græcum*); Indian River (Henshall coll., Jordan 1880); Pensacola (Jordan & Gilbert 1882, as *A. anoplus*, and Bean 1883); Key West (Jordan 1884*a*, as *A. anoplus*); and Matanzas River, St. Johns River, Pensacola and Key West (Jordan & Evermann 1898).

491. Kathetostoma albiguttum Bean.

Off Pensacola (*Albatross* coll., Bean 1892, type); lat. 28° 42′ 30″ N., long. 85° 29′ W., in 88 fathoms; lat. 28° 44′ N., long. 85° 16′ W., in 60 fathoms; lat. 26° 4′ 30″ N., long. 83° 25′ 15″ W., in 28 fathoms; and lat. 26° 33′ 30″ N., long. 83° 15′ 30″ W., in 27 fathoms, between "The Bay" and Dry Tortugas (*Albatross* coll., Goode and Bean 1896).

BATRACHOIDIDÆ. The Toad-Fishes.

492. Opsanus tau (Linnæus). *Toad-fish.*

Pensacola (Stearns coll., Goode & Bean 1879*a*, as *Batrachus tau*, and Jordan & Stearns coll., Bean 1883, as *B. tau*); St. Johns River (Goode 1879*a*, as *B. tau*); Punta Rassa (Velie coll., Goode & Bean 1879*b*, as *B. tau beta*); Key West (Jordan 1884*a*, as *B. tau*); Florida Keys (Jordan 1884*d*, as *B. tau*); Cedar Keys (Jordan & Swain 1884*a*, as *B. tau*); Big Gasparilla and Lemon Bay (Henshall 1889, as *B. tau*); Tampa (Henshall 1894, as *B. tau*); Clearwater Harbor and other places along coast (Lönnberg 1894, as *B. tau*); Key West and Anclote Sponge Kraals (Evermann & Kendall coll., 1896); and Tampa Bay (*Fish Hawk* coll., 1898).

493. Opsanus pardus (Goode & Bean). *Sapo.*

Pensacola Snapper Banks (Stearns coll., Goode & Bean 1879*a*, as *Batrachus tau*); Pensacola (Velie coll., Goode & Bean 1879*b*, type of *B. tau pardus*; Jordan & Gilbert 1882, as *B. pardus*; and Jordan & Evermann 1898); Snapper Banks (Stearns coll., Bean 1883, as *B. pardus*, and 1884; Jordan 1884*a*, as *B. pardus*); Egmont Key (Jordan 1884*c*, as *B. pardus*); west coast (Henshall 1889, as *B. pardus*); and Key West (Evermann & Kendall coll., 1896).

494. Porichthys porosissimus (Cuvier & Valenciennes). *Bagre Sapo.*

Pensacola (Jordan & Gilbert 1882, type of *Porichthys plectrodon*; Bean 1883, as *P. plectrodon*; Jordan 1884*d*; and Jordan & Swain 1884*f*); and Gulf of Mexico (Garman 1896, as *P. plectrodon*).

GOBIESOCIDÆ. The Cling-Fishes.

495. Gobiesox strumosus Cope.

Boca Grande Pass (*Fish Hawk* coll., 1889); Titusville (Evermann & Bean 1896); and Indian River (Jordan & Evermann 1898).

496. Gobiesox virgatulus Jordan & Gilbert.

Pensacola (Jordan & Gilbert 1882, type; and Bean 1883); Egmont Key (Jordan 1884*e*); Key West (Lönnberg 1894); and Pensacola Bay (Jordan & Evermann 1898).

BLENNIIDÆ. The Blennies.

497. Malacoctenus macropus (Poey).

Tortugas (Garman 1896, as *Myxodes macropus*), and Cape Florida (Evermann & Kendall coll., 1896).

498. Labrisomus nuchipinnis (Quoy & Gaimard).

Florida (De Kay 1842, as *Lepisoma cirrhosum*), and Florida Keys (Jordan & Evermann 1898).

499. Auchenopterus marmoratus (Steindachner).

Florida Keys (Bean 1883, as *Cremnobates marmoratus*); Key West (Jordan 1884*a*, as *C. marmoratus*); Cards Sound (Henshall 1889); Key West and Cape Florida (Evermann & Kendall coll., 1896); and Florida Keys and Key West (Jordan & Evermann 1898).

500. Auchenopterus affinis (Steindachner).

Key West (Jordan 1884*a*, as *Cremnobates affinis*, and Jordan & Evermann 1898); and Key West (Evermann & Kendall coll., 1896).

501. Auchenopterus fasciatus (Steindachner).

Key West (Jordan 1884*a*, as *C. fasciatus*); and Cards Sound (Henshall 1889).

502. Auchenopterus nox (Jordan & Gilbert).

Key West (Jordan & Gilbert 1884*a*, type of *Cremnobates nox;* Jordan 1884*a*, as *C. nox*, and Jordan & Evermann 1898).

503. Blennius stearnsi Jordan & Gilbert.

Pensacola Snapper Banks (Jordan & Gilbert 1882, type), and Snapper Banks (Stearns coll., Jordan 1884).

504. Blennius favosus Goode & Bean.

Garden Key (Würdemann coll., Goode & Bean 1882, type); Tortugas (Jordan 1884*a*); and Garden Key (Jordan & Evermann 1898).

505. Blennius pilicornis Cuvier & Valenciennes.

Tortugas (C. C. Cutting coll., Garman 1896).

506. Blennius cristatus Linnæus.

Garden Key (Würdemann coll., Goode & Bean 1882, type of *B. asterias;* and Jordan & Evermann 1898); Tortugas (J. B. Holder coll., Bean 1883, as *B. asterias*); and Key West (Lönnberg 1894, as *B. asterias;* and Evermann & Kendall coll., 1896).

507. Hypsoblennius ionthas (Jordan & Gilbert).

Pensacola (Jordan & Gilbert 1882, types of *Isesthes ionthas*, and as *I. scrutator*); and Pensacola Bay (Jordan & Stearns coll., Bean 1883, as *I. ionthas*).

508. Hypsoblennius hentz (Le Sueur).

Indian River Inlet (Evermann & Bean 1896, as *H. punctatus*), and Indian River (Jordan & Evermann 1898).

509. Chasmodes saburræ Jordan & Gilbert.

Pensacola (Jordan & Gilbert 1882, type; and Jordan & Stearns coll., Bean 1883); Anclote Sponge Kraals (Evermann & Kendall coll., 1896); and Pensacola Bay (Jordan & Evermann 1898).

510. Chasmodes novemlineatus (Wood).

Titusville (Evermann & Bean 1896, as *C. saburræ*), and Indian River (Jordan & Evermann 1898 .

511. Chasmodes bosquianus (Lacépède).

Florida (Bean 1883, and Jordan & Evermann 1898).

CHÆNOPSIDÆ.

512. Emblemaria atlantica Jordan & Evermann.

Snapper Banks off Pensacola (Stearns coll., Jordan & Evermann 1898, type).

513. Emblemaria nivipes Jordan & Gilbert.

Pensacola Snapper Banks (Stearns coll., Jordan 1884).

XIPHIDIIDÆ.

514. Stathmonotus hemphillii Bean.

Key West (Bean 1885, type; and Jordan & Evermann 1898).

OPHIDIIDÆ.

515. Lepophidium profundorum Gill.

Gulf stream off coast of Florida (Commodore Rodgers coll., Gill 1863*a*, type of *Leptophidium profundorum;* and Goode 1879*a*); in 30 fathoms off coast of Florida (Goode & Bean 1896).

516. Lepophidium cervinum (Goode & Bean).

About 8 miles south of Sand Key Light in 12 fathoms (Garman 1896); Snapper Grounds off Pensacola (Goode & Bean 1896); and off Sand Key Light (Jordan & Evermann 1898).

517. Ophidion beani Jordan & Gilbert.

Snapper Banks off Pensacola (Jordan & Gilbert 1882, as *Ophidium graëllsi,* and 1883, type of *O. beani*); west Florida and Pensacola (Stearns coll., Bean 1883, as *O. beanii*); Snapper Banks (Stearns coll., Jordan 1884, as *O. beani*); Pensacola (Jordan & Evermann 1886, as *O. beani*); and Snapper Banks in 21½ fathoms (*Grampus* coll., Kendall 1889, as *Ophidium,* sp.).

518. Ophidion holbrookii (Putnam).

Key West (C. J. Maynard coll., Putnam, 1874, type of *Ophidium holbrookii;* and Jordan & Evermann 1898).

519. Rissola marginata (De Kay).

Pensacola (Jordan & Gilbert 1883, as *Ophidium marginatum*).

520. Otophidium omostigma (Jordan & Gilbert).

Pensacola Snapper Banks (Jordan & Gilbert 1882, type of *Genypterus omostigma;* and Jordan & Evermann 1898); and Snapper Banks (Stearns coll., Jordan 1884).

FIERASFERIDÆ.

521. Fierasfer affinis Günther.

"Key Bisquan," Cape Florida, Tortugas (Würdemann coll., Putnam 1874); Key West (Jordan 1884*a*, as *F. dubius*); Tortugas (C. C. Nutting coll., Garman 1896, as *F. dubius*); Tortugas and Cape Florida (Würdemann coll.); and Biscayne Bay (Theodore Lyman coll., Jordan & Evermann 1898).

BROTULIDÆ.

522. Ogilbia cayorum Evermann & Kendall.

Key West (Evermann & Kendall 1897, type of genus and species; and Jordan & Evermann 1898).

523. Dicromita agassizii Goode & Bean.

Lat. 29° 11′ 30″ N., long. 85° 29′ W., in 26 fathoms, southward of Cape San Blas (Goode & Bean 1896).

524. Neobythites gilli Goode & Bean.

Lat. 28° 36 N., long. 85° 33′ W., in 111 fathoms, southward of Cape San Blas (*Albatross* coll., Goode & Bean 1885, type, and 1896).

525. Amphyonus mollis Goode & Bean.

Lat. 24° 36′ N., long. 84° 5′ W., in 955 fathoms, westward of Tortugas (*Blake* coll., Goode & Bean 1886, type, and 1896).

GADIDÆ. The Cods.

526. Physiculus fulvus Bean.

Lat. 24° 36′ N., long. 84° 5′ W., in 955 fathoms, westward of Tortugas; lat. 28° 36′ N., long. 85° 33′ 36″ W., in 111 fathoms, southward of Cape San Blas (Goode & Bean, 1896).

527. Urophycis regius (Walbaum). *Spotted Hake.*

About 8 miles south of Sand Key Light, in about 120 fathoms (Garman 1896, as *Phycis regius*).

528. Urophycis cirratus (Goode & Bean).

Lat. 29° 3′ 15″ N., long. 88° 16′ W., in 280 fathoms; lat. 28° 42′ N., long. 86° 36′ W., in 280 fathoms, southward from between Pensacola and Cape San Blas (Goode & Bean 1896, type of *Phycis cirratus*).

529. Urophycis floridana (Bean & Dresel). *Florida Hake.*

Pensacola (Stearns coll., Bean & Dresel 1882, type of *Phycis floridanus*, and Jordan & Evermann 1898), and Snapper Banks and shores near Pensacola (Jordan & Evermann 1886, as *Phycis floridanus*).

530. Læmonema melanurum Goode & Bean.

Lat. 28° 34′ N., long. 86° 48′ W., in 330 fathoms; lat. 28° 42′ N., long. 86° 36′ W., in 280 fathoms, southward from between Pensacola and San Blas (*Albatross* coll., Goode & Bean 1896, type).

MACRURIDÆ. The Grenadiers.

531. Bathygadus arcuatus Goode & Bean.

Lat. 28° 38′ 30″ N., long. 87° 2′ W., in 420 fathoms (Goode & Bean 1896).

532. Bathygadus favosus Goode & Bean.

Lat. 28° 47′ 30″ N., long. 87° 27′ W., in 724 fathoms; lat. 28° 38′ 30″ N., long. 87° 27′ W., in 724 fathoms; and lat. 28° 38′ 30″ N., long. 87° 2′ W., in 420 fathoms, southward of Pensacola (Goode & Bean 1896).

533. Bathygadus macrops Goode & Bean.

Lat. 28° 34′ N., long. 86° 48′ 33″ W., in 335 fathoms, and lat. 28° 36′ 15″ N., long. 86° 50′ W., in 347 fathoms, southward from between Pensacola and San Blas (Goode & Bean 1896).

534. Bathygadus longifilis Goode & Bean.

Lat. 28° 47′ 30″ N., long. 87° 27′ W., in 724 fathoms (*Albatross* coll., Goode & Bean 1885, type); lat. 28° 47′ 30″ N., long. 87° 27′ W., in 724 fathoms, and lat. 28° 43′ 30″ N., long. 87° 14′ 13″ W., in 525 fathoms, southward of Pensacola (*Albatross* coll., Goode & Bean 1896).

535. Hymenocephalus cavernosus (Goode & Bean).

Lat. 28° 45′ N., long. 86° 26′ W., in 227 fathoms (Goode & Bean 1885, type of *Bathygadus cavernosus*).

536. Cœlorhynchus occa (Goode & Bean).

Lat. 28° 34′ N., long. 86° 48′ 33″ W., in 335 fathoms (Goode & Bean 1885, type of *Macrurus occa*, and 1896).

537. Cœlorhynchus carminatus (Goode).

Lat. 28° 36″ N., long. 83° 33′ 30″ W., in 111 fathoms, southward of Cape San Blas; lat. 28° 42′ N., long. 86° 36′ W., in 286 fathoms; lat. 28° 34′ N., long. 86° 48′ 33″ W., in 335 fathoms; lat. 28° 45′ N., long. 86° 26′ W., in 227 fathoms; and lat. 28° 36′ N., long. 86° 50′ W., in 347 fathoms, between Pensacola and Cape San Blas (Goode & Bean 1896).

538. Cœlorhynchus caribbæus (Goode & Bean).

Lat. 29° 07′ 30″ N., long. 88° 08′ W.; lat 28° 41′ N., long. 86° 07′ W.; lat. 28° 38′ 30″ N., long. 85° 52′ 30″ W. (*Albatross* coll., Goode & Bean 1885, type of *Macrurus caribbæus*); lat. 28° 41′ N., long. 86° 07′ W., in 169 fathoms, southward from between Pensacola and Cape San Blas; and lat. 28° 38′ 30″ N., long. 87° 02′ W., in 42 fathoms, southward of Cape San Blas (Goode & Bean 1896).

539. Trachonurus sulcatus (Goode & Bean).

Lat. 28° 38′ 30″ N., long. 87° 2′ W., in 420 fathoms (Goode & Bean 1885, type of *Coryphænoides sulcatus*).

BREGMACEROTIDÆ.

540. Bregmaceros atlanticus Goode & Bean.

Snapper Grounds in 23 and 24 fathoms (*Grampus* coll., Kendall 1889); and lat. 25° 33′ N., long. 84° 21′ W., northwestward of Tortugas (Goode & Bean 1896).

PLEURONECTIDÆ. The Flounders.

541. Paralichthys dentatus (Linnæus). *Summer Flounder.*

Cape Cod to Florida (Jordan & Goss 1886, and Jordan & Evermann 1898).

542. Paralichthys lethostigmus Jordan & Gilbert. *Southern Flounder.*

St. Johns River and St. Augustine (Goode 1879*a*, as *Pseudorhombus dentatus*); Pensacola (Stearns coll., Goode & Bean 1879*a*, as *P. dentatus*); St. Johns River (Bean 1880, and 1883, as *P. dentatus;* Jordan & Gilbert, in Jordan & Meek 1884, type); Tampa (Henshall 1894); Indian River at Stuart (Evermann & Bean 1896, as *P. lethostigma*); Tampa Bay (*Fish Hawk* coll., 1898).

543. Paralichthys squamilentus Jordan & Gilbert.

Pensacola (Jordan & Gilbert 1882, type; Stearns coll., Bean 1883; Jordan & Goss 1886; and Jordan & Evermann 1898); Egmont Key (Henshall 1889); and Biscayne Bay (McCormick coll., Smith 1895).

544. Paralichthys albiguttus Jordan & Gilbert.

Pensacola (Jordan & Gilbert 1882, type); Cedar Keys (Jordan & Swain 1884*a*, and Jordan & Evermann 1898); Gulf coast (Jordan & Goss 1886); Marco, Gordon Pass, Big Gasparilla, and Lemon Bay (Henshall 1889); Clearwater Harbor (Lönnberg 1894); Indian River at Fort Pierce (Evermann & Bean 1896, as *P. lethostigma*); and Key West (C. B. Hudson coll., 1897).

545. Limanda beanii Goode.

Lat. 28° 45′ N., long. 86° 26′ W., in 227 fathoms; lat. 28° 44′ N., long. 86° 18′ W., in 196 fathoms; lat. 28° 41′ N., long. 86° 7′ W., in 169 fathoms, between Pensacola and Cape San Blas; lat. 28° 38′ 30″ N., long. 85° 52′ 30″ W., in 142 fathoms; and lat. 28° 36′ N., long. 85° 33′ 30″ W., in 111 fathoms, southward of Cape San Blas (*Albatross* coll., Goode & Bean 1896).

546. Platophrys ocellatus (Agassiz).

Key West (Jordan & Gilbert 1884, and Jordan 1884*a*, as *P. nebularis;* and Jordan & Goss 1886); Key West and Garden Key (Henshall 1889); Biscayne Bay (McCormick coll., Smith 1895); Tortugas (Garman 1896); and Cape Florida (Evermann & Kendall coll., 1896); lat. 24° 43′ N., long. 83° 25′ W., in 37 fathoms, westward of Dry Tortugas; lat. 24° 25′ 45″ N., long. 81° 46′ W., in 45 fathoms, off Sand Key; lat. 28° 45′ N., long. 85° 2′ W., in 30 fathoms, off Cape San Blas; lat. 28° 46′ N., long. 84° 49′ W., in 26 fathoms, off Cape St. George; lat. 25° 4′ 30″ N., long. 82° 59′ 15″ W., in 26 fathoms, northward of Tortugas; lat. 28° 47′ 30″ N., long. 84° 37′ W., in 24 fathoms, southward of Apalachicola (*Albatross* coll., Goode & Bean 1896); and Key West and Tortugas (Jordan & Evermann 1898).

547. Platophrys lunatus (Linnæus).

Green Turtle Key (Jordan & Everman 1898).

548. Syacium papillosum (Linnæus).

Pensacola (Bean in Jordan & Gilbert 1882, type of *Hemirhombus pætulus;* Goode & Bean 1882, as *H. pætulus;* Jordan & Gilbert 1883, as *H. pætulus*; Stearns coll., Jordan 1884, as *Citharichthys pætulus;* and Jordan & Goss 1886); Pensacola and Snapper Banks (Stearns coll., Bean 1883, as *H. pætulus;* Pensacola; lat. 24° 43′ N., long. 83° 25′ W., in 37 fathoms, westward of Tortugas; lat. 24° 46′ N., long. 83° 16′ W., in 36 fathoms, northwestward of Tortugas; lat. 28° 42′ 30″ N., long. 85° 29′ W., in 88 fathoms, off Cape San Blas; lat. 26° 33′ 30″ N., long. 88° 15′ 30″ W., in 27 fathoms, westward of Charlotte Harbor; lat. 26° N., long. 82° 57′ 30″ W., in 27 fathoms, westward of Cape Romano; lat. 25° 4′ 30″ N., long. 82° 59′ 15″ W., in 26 fathoms, northwest of Tortugas; lat. 28° 46′ N., long. 84° 49′ W., in 26 fathoms, southward from between Cape St. George and Apalachicola; and lat. 28° 28′ N., long. 84° 25′ W., in 21 fathoms, off Apalachicola (*Albatross* coll., Goode & Bean 1896, as *C. pætulus*).

549. Syacium micrurum Ranzani.

Key West (Jordan 1884*a*, as *Citharichthys ocellatus;* Jordan & Goss 1886; Henshall 1894; Lönnberg 1894, as *C. ocellatus;* and Jordan & Evermann 1898).

550. Cyclopsetta fimbriata (Goode & Bean).

Lat. 28° 42′ 30″ N., long. 84° and 85° W. (*Albatross* coll., Goode & Bean 1885, type of *Hemirhombus fimbriatus*); lat. 28° 42′ 30″ N., long. 85° 29′ W., in 88 fathoms, southward of Cape San Blas, and lat. 28° 47′ 30″ N., long. 84° 37′ W., in 24 fathoms, off Cape St. George (*Albatross* coll., Goode & Bean 1896).

551. Ancylopsetta quadrocellata Gill.

Pensacola (Goode & Bean 1879*a*, and Goode 1879*a*, as *Pseudorhombus quadrocellatus*), and Cedar Keys (Jordan & Swain 1884*a*, as *Paralichthys ommatus*).

552. Notosema dilectum (Goode & Bean).

Lat. 28° 42′ 30″ N., long. 85° 29′ W., in 88 fathoms, southward of Cape San Blas (Goode & Bean 1896).

553. Gastropsetta frontalis B. A. Bean.

Near Key West, lat. 24° 25′ 45″ N., long. 81° 46′ 45″ W., in 45 fathoms (*Albatross* coll., B. A. Bean 1894, type); and Key West (Jordan & Evermann 1898).

554. Citharichthys unicornis Goode.

Lat. 24° 25′ 45″ N., long. 81° 46′ W., in 45 fathoms, off Sand Key; lat. 28° 38′ 30″ N., long. 85° 52′ 30″ W., in 142 fathoms; lat. 28° 36′ N., long. 85° 33′ 30″ W., in 111 fathoms; and lat. 28° 44′ N., long. 85° 16′ W., in 60 fathoms, southward of Cape San Blas (Goode & Bean 1896).

555. Citharichthys macrops Dresel.

Pensacola (Dresel 1884, type); Lacosta Island (*Grampus* coll., Kendall 1889); and Big Gasparilla and Egmont Key (Henshall 1889).

556. Citharichthys spilopterus Günther.

St. Johns River (Goode 1879*a*); Pensacola (Stearns coll., Goode & Bean 1879*a*); Stuart (Evermann & Bean 1896).

557. Etropus microstomus (Gill).

Pensacola (Jordan & Goss 1886). Doubtful.

558. Etropus rimosus Goode & Bean.

Coast of Florida between Pensacola and Cedar Keys, dredged in 21 fathoms (Goode & Bean 1885, type), and lat. 28° 28′ N., long. 84° 25′ W., in 21 fathoms, between Cape St. George and Apalachicola (Goode & Bean 1896).

559. Etropus crossotus Jordan & Gilbert.

St. Johns River (Baird coll., Bean 1883); Cedar Keys (Jordan & Swain 1884*a*, and Jordan & Goss 1886); Pensacola (Jordan & Evermann 1886); Gordon Pass and San Carlos Pass (Henshall 1889); and Tampa Bay (*Fish Hawk* coll., 1898).

560. Monolene sessilicauda Goode.

Off Key West (Garman 1896); off Alligator Key, in 85 fathoms; lat. 28° 36′ N., long. 85° 33′ 30″ W., in 111 fathoms, off Cape San Blas (Goode & Bean 1896); and Key West (Jordan & Evermann 1898).

561. Achirus inscriptus Gosse.

Key West (Jordan 1884, and Jordan & Goss 1886), and Cape Florida (Smith coll., 1895, and Evermann & Kendall coll., 1896).

562. Achirus lineatus (Linnæus).

St. Johns River (Goode 1879*a*); Pensacola (Stearns coll., Goode & Bean 1879*a;* Jordan & Gilbert 1882; and Stearns coll., Bean 1883, as *A. lineatus browni*); Apalachicola Bay (Goode & Bean 1882, as *Baiostoma brachialis*, genus and species new); Key West (Jordan & Gilbert 1884*a*, type of *A. comifer*, and Jordan 1884, as *A. comifer*); Egmont Key (Jordan 1884*a*, and 1884*e*, as *A. brachialis*, and Jordan & Goss 1886); Barnes Sound, Gordon Pass, and Big Gasparilla (Henshall 1889); Biscayne Bay (McCormick coll., Smith 1895); Lake Worth (Smith coll., 1895); Stuart (Evermann & Bean 1896); Cape Florida, Key West and Tarpon Springs (Evermann & Kendall coll., 1896); Pensacola, Egmont Key and Key West (Jordan & Evermann 1898); Tampa Bay (*Fish Hawk* coll., 1898).

563. **Achirus fasciatus** Lacépède.

Volusia and Bayport (Cope 1877, as *A. mollis*); Pensacola (Jordan & Goss 1886, and Jordan & Evermann 1898); Myakka River (Henshall 1889); Alligator River, Punta Gorda, Joshua, Charlie Apopka, and Oak creeks, Alligator Branch and Peace River at Wauchula (Woolman 1890); Peace River (Lönnberg 1894); Anclote Sponge Kraals, Anclote River at Pindar's Landing (Evermann & Kendall coll., 1896); St. Johns River at Welaka (Kendall coll., 1897); and Tampa Bay (*Fish Hawk* coll., 1898).

564. **Symphurus piger** (Goode & Bean).

Off Key West, and between delta of Mississippi and Cedar Keys; lat. 24° 25′ 45″ N., long. 81° 46′ 45″ W., in 45 fathoms, off Sand Key (*Blake* coll., Goode & Bean 1886, type of *Aphoristia pigra*); lat. 28° 45′ N., long. 85° 2′ W., in 30 fathoms, off Cape St. George; and lat. 29° 11′ 30″ N., long. 85° 29′ W., in 26 fathoms, off Cape San Blas (Goode & Bean 1896).

565. **Symphurus plagusia** (Bloch & Schneider). *Tongue-fish.*

Off Key West, in about 20 fathoms (Garman 1896).

566. **Symphurus plagiusa** (Linnæus). *Tongue-fish.*

St. Johns River (Jordan 1880*a*, as *Aphoristia plagiusa*); Pensacola (Jordan & Gilbert 1882, as *A. plagiusa*, and Stearns coll., Bean 1883, as *A. plagiusa*); Cedar Keys (Jordan & Swain 1884*a*, as *A. plagiusa*); Key West (Jordan 1884*a*, as *A. plagiusa*); Egmont Key (Jordan 1884*e*, as *A. plagiusa*); Florida Keys and Key West (Jordan & Goss 1886); Snapper Grounds, in 37 fathoms (*Grampus* coll., Kendall 1889, as *A. plagiusa*); Marco, Gordon Pass, Big Gasparilla, Lemon Bay, and Long Boat Key (Henshall 1889); Biscayne Bay (McCormick coll., Smith 1895); Indian River Inlet (Evermann & Bean 1896); Pensacola and Key West (Jordan & Evermann 1898); Tampa Bay (*Fish Hawk* coll., 1898).

567. **Symphurus diomedeana** (Goode & Bean).

Lat. 25° 4′ 30″ N., long. 82° 59′ 15″ W., north of Tortugas (*Albatross* coll., Goode & Bean 1885, as *Aphoristia diomedeana*, type).

ANTENNARIIDÆ.

568. **Pterophryne histrio** (Linnæus).

St. Augustine and mouth of St. Johns River (Goode 1879*a*).

569. **Antennarius ocellatus** (Bloch & Schneider).

Key West (Gill 1863, type of *A. pleuropthalmus*, and C. B. Hudson coll., 1897); Egmont Key (Jordan 1884*e*); Snapper Grounds, in 38 fathoms (*Grampus* coll., Kendall 1889, as *Antennarius* sp.?); lat. 24° 31′ N., long. 83° 16′ W., in 36 fathoms, westward of Tortugas; lat. 28° 44′ N., long. 85° 16′ W., in 60 fathoms; lat. 28° 45′ N., long. 85° 2′ W., in 30 fathoms, southward of Cape St. George; and lat. 24° 25′ 45″ N., long. 81° 46′ 45″ W., in 45 fathoms, northward of Tortugas (Goode & Bean 1896, as *A. pleuropthalmus*).

570. **Antennarius nuttingii** (Garman).

Nearly 8 miles south of Sand Key Light, in 120 fathoms (Garman 1896, type of *Chaunax nuttingii*).

571. **Antennarius multiocellatus** (Cuvier & Valenciennes).

Garden Key (Lieutenant Wright coll., Gill 1863, type of *A. annulatus*).

572. **Antennarius radiosus** Garman.

Off Key West, in 50 fathoms (Garman 1896, type).

OGCOCEPHALIDÆ. The Bat-Fishes.

573. Ogcocephalus vespertilio (Linnæus). *Bat-fish.*

Pensacola (Bean 1883, as *Malthe vespertilio*); Egmont Key (Jordan 1884*c*, as *M. vespertilio*); south of Key West in 60 fathoms (Garman 1896, as *Oncocephalus vespertilio*); lat. 24° 46′ N., long. 83° 16′ W., in 36 fathoms; lat. 24° 43′ N., long. 83° 25′ W., in 37 fathoms, westward of Tortugas; lat. 28° 36′ N., long. 85° 33′ 30″ W., in 111 fathoms, off Cape San Blas; lat. 28° 44′ N., long. 85° 16′ W., in 60 fathoms, southward between Pensacola and Cape San Blas; lat. 28° 44′ N., long. 85° 2′ W., in 30 fathoms; lat. 28° 46′ N., long. 84° 49′ W., in 26 fathoms, southward of Cape St. George; and lat. 24° 25′ N., long. 45° 8′ 46″ W., in 45 fathoms, off Sand Key (Goode & Bean 1896, as *Oncocephalus vespertilio*).

574. Ogcocephalus radiatus (Mitchill). *Bat-fish.*

St. Augustine (Goode 1879*a*, as *Malthe cubifrons;* and J. M. Lang coll., Bean 1883, as *M. cubifrons*); Pensacola (Stearns coll., Goode & Bean 1879*a*, as *M. cubifrons*); Key West (Jordan 1884*a*, as *M. radiata;* and Evermann & Kendall coll., 1896); Cedar Keys (Jordan & Swain 1884, as *M. vespertilio*); west coast of Florida (Henshall 1889, as *M. radiata*); Tampa (Henshall 1894, as *M. radiata*); and Clearwater Harbor (Lönnberg 1894, as *M. radiata*).

575. Halieutichthys aculeatus (Mitchill).

Key West (Velie coll., Goode & Bean 1879*b;* and Jordan 1884*a*, as *H. reticulatus*); Pensacola (Jordan & Evermann 1886, as *H. reticulatus*); lat. 24° 25′ 45″ N., long. 81° 46′ 45″ W., in 45 fathoms, off Sand Key; lat. 28° 44′ N., long. 85° 16′ W., in 60 fathoms; lat. 28° 45′ N., long. 85° 2′ W., in 30 fathoms, off Cape St. George; lat. 28° 47′ 30″ N., long. 84° 37′ W., in 24 fathoms, off Cape St. George; lat. 27° 4′ N., long. 83° 21′ 15″ W., in 26 fathoms, westward of Corey Pass; and lat. 26° 32′ 30″ N., long. 83° 15′ 30″ W., in 30 fathoms, southward of Sanibal Island (Goode & Bean, 1896).

576. Dibranchus atlanticus (Peters).

Lat. 28° 34′ N., long. 86° 48′ 33″ W., in 335 fathoms; lat. 28° 36′ 15″ N., long. 86° 50′ W., in 317 fathoms; lat. 28° 45′ N., long. 86° 26′ W., in 227 fathoms; lat. 28° 38′ 30″ N., long. 87° 2′ W., in 420 fathoms, southward of Pensacola; lat. 28° 42′ N., long. 86° 36′ W., in 280 fathoms; and lat. 28° 34′ N., long. 86° 48′ 33″ W., in 335 fathoms, southward from between Pensacola and Cape San Blas (*Albatross* coll., Goode & Bean 1896).

SPECIES DESCRIBED AS NEW FROM FLORIDA LOCALITIES.

In the following list are given (1) a catalogue of the nominal species of fishes which have been described from Florida localities, together with the authority for each; (2) the present identification of each; (3) the type locality, or particular place from which were obtained the specimens upon which the original descriptions of the species were based; (4) the year when each species was described.

In order to show the progress of ichthyological investigations in this State the names have been arranged in chronologic order.

The names in the first column, not now regarded as tenable, are printed in italics.

The dates given in the fourth column are those upon which the species were actually published.

From this list it may be seen that 174 nominal species have been described from Florida localities, and that 120 of these are still regarded as good species.

List of species described as new from Florida localities.

Nominal species.	Present identification.	Type locality.	Year.
Mollienisia multilineata Le Sueur	Mollienisia latipinna	East Florida	1821
Lebias ellipsoidea Le Sueur	Cyprinodon variegatus	do	1821
Cichla floridana Le Sueur	Micropterus salmoides	do	1822
Trygon sabina Le Sueur	Dasyatis sabina	Florida	1824
Raia desmarestia Le Sueur	Raja eglanteria	do	1824
Calliurus floridensis Holbrook	Chænobryttus gulosus	St. Johns River	1855
Bryttus fasciatus Holbrook	Enneacanthus obesus	do	1855
Pomotis elongatus Holbrook	Lepomis auritus	do	1855
Pomotis speciosus Holbrook	Eupomotis holbrooki	do	1855
Pomotis marginatus Holbrook	Lepomis megalotis	do	1855
Gambusia holbrooki Girard	Gambusia affinis	Palatka	1859
Fundulus floridensis Girard	Fundulus grandis	Charlotte Bay	1859
Fundulus seminolis Girard	Fundulus seminolis	Palatka	1859
Esox ravenelii Holbrook	Lucius americanus	East Florida	1860
Leptophidium profundorum Gill	Lepophidium profundorum	Gulf Stream, off Florida coast	1863
Antennarius annulatus Gill	Antennarius multiocellatus	Garden Key	1863
Antennarius pleurophthalmus Gill	Antennarius ocellatus	Key West	1863
Centropristes subligarius Cope	Dules subligarius	Pensacola	1870
Ophidium holbrookii Putnam	Ophidion holbrookii	Key West	1874
Lepomis mysticalis Cope	Lepomis auritus	Volusia and East Florida	1877
Xystroplites longimanus Cope	Eupomotis holbrooki	Volusia and Bayport	1877
Xystroplites gillii Jordan	Eupomotis pallidus	Garden Key	1877
Amiurus erebennus Jordan	Ameiurus erebennus	St. Johns River	1877
Lutjanus stearnsii Goode & Bean	Neomænis griseus	Pensacola	1878
Erimyzon goodei Jordan	Erimyzon sucetta	St. Johns River	1878
Epinephelus drummond-hayi Goode & Bean	Epinephelus drummond-hayi	Pensacola	1878
Caulolatilus microps Goode & Bean	Caulolatilus microps	Snapper Banks, off Pensacola	1878
Lutjanus blackfordii Goode & Bean	Neomænis aya	do	1878
Chirostoma peninsulæ Goode & Bean	Menidia peninsulæ	Pensacola	1879
Chirostoma vagrans Goode & Bean	Kirtlandia vagrans	do	1879
Jordanella floridæ Goode & Bean	Jordanella floridæ	Lake Monroe	1879
Fundulus confluentus Goode & Bean	Fundulus confluentus	do	1879
Gambusia arlingtonia Goode & Bean	Fundulus chrysotus	Arlington River	1879
Trisotropis microlepis Goode & Bean	Mycteroperca microlepis	Pensacola	1879
Hæmulon fremebundum Goode & Bean	Hæmulon macrostoma	Clearwater Harbor	1879
Harengula pensacolæ Goode & Bean	Sardinella humeralis	Pensacola	1879
Sphagebranchus scuticaris Goode & Bean	Bascanichthys scuticaris	Cedar Keys	1879
Seriola stearnsii Goode & Bean	Seriola zonata carolinensis	Pensacola	1879
Diapterus homonymus Goode & Bean	Eucinostomus gula	Clearwater Harbor	1879
Eucinostomus harengulus Goode & Bean	Eucinostomus harengulus	West Florida	1879
Pagellus milneri Goode & Bean	Calamus penna	Pensacola	1879
Zygonectes henshalli Jordan	Fundulus chrysotus	San Sebastian River	1880
Lucania goodei Jordan	Fundulus goodei	Arlington River	1880
Rhinobatus lentiginosus Garman	Rhinobatus lentiginosus	Coast of Florida	1880
Atherina veliana Goode & Bean	Atherina laticeps	Clearwater Harbor	1880

Batrachus tau pardus Goode & Bean	Opsanus pardus	Pensacola	1880
Engraulis hiulcus Goode & Bean	Stolephorus brownii	Clearwater Harbor	1880
Raja ornata Garman	Raja ornata	Alligator Key	1881
Narcine brasiliensis corallina Garman	Narcine brasiliensis	Florida	1881
Menidia dentex Goode & Bean	Menidia menidia	St. Johns River	1882
Cyprinodon mydrus Goode & Bean	Cyprinodon carpio	Pensacola	1882
Tylosurus gladius Goode & Bean	Tylosurus raphidoma	do	1882
Chriodorus atherinoides Goode & Bean	Chriodorus atherinoides	Key West	1882
Trisotropis stomias Goode & Bean	Mycteroperca microlepis	Pensacola	1882
Hypoplectrus gemma Goode & Bean	Hypoplectrus gemma	Garden Key	1882
Calamus arctifrons Goode & Bean	Calamus arctifrons	Pensacola	1882
Letharchus velifer Goode & Bean	Letharchus velifer	West Florida	1882
Opisthognathus scaphiurus Goode & Bean	Opisthognathus macrognathum	Garden Key	1882
Blennius favosus Goode & Bean	Blennius favosus	do	1882
Blennius asterias Goode & Bean	Blennius cristatus	do	1882
Gerres olisthostoma Goode & Bean	Gerres olisthostoma	Indian River	1882
Gobius boleosoma Jordan & Gilbert	Gobius boleosoma	Laguna Grande, at Pensacola	1882
Opisthognathus lonchurus Jordan & Gilbert	Opisthognathus lonchurum	Snapper Banks, off Pensacola	1882
Porichthys plectrodon Jordan & Gilbert	Porichthys porosissimus	Pensacola	1882
Gobiesox virgatulus Jordan & Gilbert	Gobiesox virgatulus	do	1882
Blennius stearnsi Jordan & Gilbert	Blennius stearnsi	Snapper Banks, off Pensacola	1882
Ophidium beani Jordan & Gilbert	Ophidion beani	do	1882
Genypterus omostigma Jordan & Gilbert	Otophidium omostigma	do	1882
Fundulus ocellaris Jordan & Gilbert	Fundulus confluentus	Pensacola	1882
Platyglossus florealis Jordan & Gilbert	Iridio bivittatus	do	1882
Paralichthys squamilentus Jordan & Gilbert	Paralichthys squamilentus	do	1882
Paralichthys albigutta Jordan & Gilbert	Paralichthys albiguttus	do	1882
Chasmodes saburræ Jordan & Gilbert	Chasmodes saburræ	do	1882
Isesthes scrutator Jordan & Gilbert	Hypsoblennius ionthas	do	1882
Tetrodon nephelus Goode & Bean	Spheroides nephelus	Indian River	1882
Gobius stigmaturus Goode & Bean	Gobius stigmaturus	Florida Keys?	1882
Scorpæna calcarata Goode & Bean	Scorpæna inermis	Clearwater Harbor	1882
Baiostoma brachialis Goode & Bean	Achirus lineatus	Apalachicola	1882
Conger caudicula Goode & Bean	Leptocephalus caudilimbatus	Pensacola	1882
Scorpæna stearnsii Goode & Bean	Scorpæna brasiliensis	do	1882
Stolephorus perthecatus Goode & Bean	Stolephorus perthecatus	do	1882
Siphostoma crinigerum Bean & Dresel	Siphostoma crinigerum	do	1882
Ophichthys guttifer Bean & Dresel	Ophichthus guttifer	Snapper Banks, off Pensacola	1882
Phycis floridanus Bean & Dresel	Urophycis floridanus	Pensacola	1882
Hippocampus stylifer Jordan & Gilbert	Hippocampus stylifer	Snapper Banks, off Pensacola	1882
Siphostoma zatropis Jordan & Gilbert	Corythroichthys albirostris	do	1882
Hippocampus zosteræ Jordan & Gilbert	Hippocampus zosteræ	Laguna Grande at Pensacola	1882
Fundulus xenicus Jordan & Gilbert	Adinia multifasciata	Pensacola	1882
Apogon alutus Jordan & Gilbert	Apogonichthys alutus	do	1882
Isesthes ionthas Jordan & Gilbert	Hypsoblennius ionthas	do	1882
Chromis enchrysurus Jordan & Gilbert	Chromis enchrysurus	do	1882
Stenotomus caprinus Bean	Otrynter caprinus	Snapper Banks, off Pensacola	1882
Ioglossus calliurus Bean	Ioglossus calliurus	Pensacola	1882
Aprion ariommus Jordan & Gilbert	Rhomboplites aurorubens	do	1883
Sparisoma cyanolene Jordan & Swain	Sparisoma hoplomystax	Key West	1884
Elassoma evergladei Jordan	Elassoma evergladei	Indian River	1884
Cæcula bascanium Jordan	Bascanichthys bascanium	Egmont Key	1884

List of species described as new from Florida localities—Continued.

Nominal species.	Present identification.	Type locality.	Year.
Myrophis egmontis Jordan	Ahlia egmontis	Egmont Key	1884
Gnathypops mystacina Jordan	Gnathypops mystacina	Snapper Banks, off Pensacola	1884
Atherina aræa Jordan & Gilbert	Atherina aræa	Key West	1884
Cremnobates nox Jordan & Gilbert	Auchenopterus nox	do	1884
Calamus proridens Jordan & Gilbert	Calamus proridens	do	1884
Paralichthys lethostigma Jordan & Gilbert	Paralichthys lethostigmus	St. Johns River	1884
Dussumiera stolifera Jordan & Gilbert	Jenkinsia stolifera	Key West	1884
Siphostoma mackayi Swain & Meek	Siphostoma mackayi	do	1884
Querimana gyrans Jordan & Gilbert	Querimana gyrans	do	1884
Tylosurus sagitta Jordan & Gilbert	Tylosurus timucu	do	1884
Xyrichthys rosipes Jordan & Gilbert	Novaculichthys rosipes	do	1884
Doratonotus thalassinus Jordan & Gilbert	Doratonotus megalepis	do	1884
Achirus comifer Jordan & Gilbert	Achirus lineatus	do	1884
Gobiosoma ceuthœcum Jordan & Gilbert	Barbulifer ceuthœcus	do	1884
Narcine umbrosa Jordan	Narcine brasiliensis	do	1884
Heterandria ommata Jordan	Lucania ommata	Indian River, near Titusville	1884
Citharichthys macrops Dresel	Citharichthys macrops	Pensacola	1885
Prionotus stearnsi Jordan & Swain	Prionotus stearnsi	Snapper Banks, off Pensacola	1885
Prionotus ophryas Jordan & Swain	Prionotus ophryas	do	1885
Cryptotomus beryllinus Jordan & Swain	Cryptotomus beryllinus	Key West	1885
Mycteroperca falcata phenax Jordan & Swain	Mycteroperca falcata phenax	Pensacola Snapper Banks	1885
Mycteroperca xanthosticta Jordan & Swain	Mycteroperca bonaci xanthosticta	Pensacola	1885
Anthias vivanus Jordan & Swain	Hemianthias vivanus	do	1885
Sparisoma xystrodon Jordan & Swain	Sparisoma xystrodon	Key West	1885
Stathmonotus hemphillii Bean	Stathmonotus hemphillii	do	1885
Zygonectes auroguttatus Hay	Fundulus cingulatus	Westville	1885
Neobythites gilli Goode & Bean	Neobythites gilli	Southward from Cape San Blas	1885
Etropus rimosus Goode & Bean	Etropus rimosus	Between Pensacola and Cedar Keys	1885
Aphoristia diomedeana Goode & Bean	Symphurus diomedeana	North of Tortugas	1885
Bathygadus longifilis Goode & Bean	Bathygadus longifilis	Off Pensacola	1885
Macrurus caribbæus Goode & Bean	Cœlorhynchus caribbæus	do	1885
Hemirhombus fimbriatus Goode & Bean	Cyclopsetta fimbriata	do	1885
Macrurus occa Goode & Bean	Cœlorhynchus occa	do	1885
Coryphænoides sulcatus Goode & Bean	Trachonurus sulcatus	do	1885
Scarus evermanni Jordan	Scarus evermanni	Snapper Banks, off Tampa	1886
Chætodon aya Jordan	Chætodon aya	Snapper Banks, off Pensacola	1886
Steinegeria rubescens Jordan & Evermann	Steinegeria rubescens	Snapper Banks	1886
Serranus ocyurus Jordan & Evermann	Centropristes ocyurus	do	1886
Corvula sialis Jordan & Eigenmann	Corvula sialis	Key West	1886
Eques acuminatus umbrosus Jordan & Eigenmann	Eques acuminatus umbrosus	Pensacola	1886
Scarus bollmani Jordan & Evermann	Scarus bollmani	Snapper Banks, off Tampa Bay	1886
Callechelys muræna Jordan & Evermann	Callechelys muræna	Snapper Banks, off Pensacola	1886
Prionotus roseus Jordan & Evermann	Prionotus roseus	do	1886
Aphoristia pigra Goode & Bean	Symphurus piger	Off Sand Key	1886
Amphyomus mollis Goode & Bean	Amphyomus mollis	Westward from Tortugas	1886

Zygonectes escambiæ Bollman	Fundulus guttatus	Flomaton, Ala	1886
Ictalurus okeechobeensis Heilprin	Ameiurus okeechobeensis	Lake Okeechobee	1887
Bathygadus cavernosus Goode & Bean	Hymenocephalus cavernosus	Off Pensacola	1885
Ophichthys retropinnis Eigenmann	Ophichthus retropinnis	Snapper Banks, off Pensacola	1887
Xyrichthys jessiæ Jordan	Xyrula jessiæ	Off Tampa Bay	1888
Callionymus bairdi Jordan	Callionymus bairdi	Snapper Banks, off Pensacola	1888
Callionymus calliurus Eigenmann & Eigenmann	Callionymus calliurus	Off South Beach, Key West	1888
Sphagebranchus kendalli Gilbert	Verma kendalli	Snapper Banks, off Pensacola	1890
Gordiichthys irretitus Jordan & Davis	Gordiichthys irretitus	....do	1892
Kathetostoma albiguttum Bean	Kathetostoma albiguttum	Off Pensacola	1892
Gastropsetta frontalis B. A. Bean	Gastropsetta frontalis	Near Key West	1895
Prionotus militaris Goode & Bean	Bellator militaris	Southward from Cape San Blas	1896
Pontinus longispinis Goode & Bean	Pontinus longispinis	Southward from Pensacola	1896
Trachinotus goodei Jordan & Evermann	Trachinotus goodei	Key West	1896
Peristedion gracile Goode & Bean	Peristedion gracile	Southward from Cape San Blas	1896
Læmonema melanurum Goode & Bean	Læmonema melanurum	Between Pensacola and Cape San Blas	1896
Phycis cirratus Goode & Bean	Urophycis cirratus	....do	1896
Aldrovandia gracilis Goode & Bean	Aldrovandia gracilis	South of Pensacola	1896
Echiostoma margarita Goode & Bean	Echiostoma margarita	Off Pensacola	1896
Bathytractes (Talismania) antillarum Goode & Bean	Talismania antillarum	South of Pensacola	1896
Conocara macdonaldi Goode & Bean	Conocara macdonaldi	West of Tortugas	1896
Benthosaurus grallator Goode & Bean	Benthosaurus grallator	....do	1896
Lampanyctus lacerta Goode & Bean	Lampanyctus lacerta	South of Cape San Blas	1896
Antennarius radiosus Garman	Antennarius radiosus	Off Key West	1896
Chaunax nuttingii Garman	Antennarius nuttingii	South of Sand Key Light	1896
Dermatolepis zanclus Evermann & Kendall	Dermatolepis zanclus	Key West	1898
Lyosphæra globosa Evermann & Kendall	Lyosphæra globosa	Biscayne Bay	1898
Ogilbia cayorum Evermann & Kendall	Ogilbia cayorum	Key West	1898
Notropis welaka Evermann & Kendall	Notropis welaka	St. Johns River at Welaka	1898
Corythroichthys cayorum Evermann & Kendall	Corythroichthys cayorum	Key West	1898
Angelichthys isabelita Jordan & Rutter	Angelichthys isabelita	....do	1898
Emblemaria atlantica Jordan & Evermann	Emblemaria atlantica	Snapper Banks, off Pensacola	1898

STATISTICS OF THE FISHERIES OF THE GULF STATES.

PREPARED IN THE DIVISION OF STATISTICS AND METHODS OF THE FISHERIES, UNITED STATES FISH COMMISSION.

C. H. TOWNSEND, Assistant in Charge.

INTRODUCTORY NOTE.

The following report on the condition of the commercial fisheries of the Gulf States is based upon a canvass of the region made in 1898, the information relating to the year 1897. Condensed information on this subject has already been made public in Statistical Bulletin No. 8, Fisheries of the Gulf States, single-sheet statistical bulletins relating to the condition of the fisheries usually being prepared upon the completion of field work and distributed in advance of full reports appearing in the regular publications of the Commission.

The report has been prepared under the direction of Mr. C. H. Townsend, assistant in charge of the Division of Fisheries.

The agents of the division participating in the field investigations were: Messrs. Charles H. Stevenson, in Texas and Louisiana; Ansley Hall, in Mississippi and Alabama, and John N. Cobb, in western Florida. The agents were familiar with the fields allotted to them, having at some previous time canvassed the fisheries of the same States. In addition to the purely statistical matter, they have furnished explanatory notes, which have been inserted under the proper headings.

The preparation of the extensive series of tables has been chiefly in the hands of Mr. S. Le R. Pritchard.

George M. Bowers,
U. S. Commissioner of Fish and Fisheries.

STATISTICS OF THE FISHERIES OF THE GULF STATES.

GENERAL NOTES AND STATISTICS.

The fisheries of the Gulf States, as considered in the present report, are the commercial fisheries of the coastal waters, no inquiries being made respecting fishing carried on irregularly above tidal waters.

The last canvass of the fisheries of this region was made in 1890.* While there has been an increase in the number of persons engaged, there has been a decrease in the amount of capital invested and in the value of the product. The fishery conditions in 1897 were, however, not quite normal, owing to unsettled conditions in Cuba, quarantine restrictions, and the storms of previous years, which destroyed much of the outfit of the fishermen. The region has very important fishery resources throughout its vast extent of coast line, but they are far from being well developed.

The fisheries of the Gulf States in 1897 gave employment to 13,967 persons, 11,180 being fishermen and 2,787 shoresmen. The largest number is credited to Florida, where 5,011 were engaged. Louisiana ranks next with 4,403, followed by Mississippi with 2,565, and Texas with 1,199. In Alabama the number of persons employed amounted to 789. There has been an increase of 2,215 in the number of persons engaged in the Gulf fisheries since 1890, at which time the total number was 11,752. About one-fourth of the fishing population is composed of unnaturalized persons.

The money invested in the industry was $2,584,061; nearly one-half of this sum, $1,149,262, is credited to western Florida; $518,301 to Mississippi, $513,813 to Louisiana, $237,496 to Texas, and $165,189 to Alabama. There has been a decrease of $394,231 in the amount of capital invested in the fisheries in this region since 1890.

The total number of vessels employed was 425, valued with their outfits at $717,076. 6,025 boats were used, valued at $436,041.

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* The following publications, emanating chiefly from the U. S. Fish Commission, should be consulted in this connection:

Fisheries of the Gulf of Mexico. Silas Stearns. The Fisheries and Fishery Industries of the United States, section II. Geographical Review of the Fisheries for 1880.

Report on the Fisheries of the Gulf States. J. W. Collins and H. M. Smith. Bulletin U. S. Fish Commission, 1891.

Report on the Coast Fisheries of Texas. Charles H. Stevenson. Report U. S. Fish Commission, 1889 to 1891.

The Fish and Fisheries of the Coastal Waters of Florida. Transmitted to the United States Senate by the Commissioner of Fish and Fisheries, January 28, 1897. Senate Document 100, Fifty-fourth Congress, second session. See also pp. 263–342, Report of U. S. Fish Commissioner for 1896.

The apparatus of capture was valued at $137,216, and the shore property and cash capital at $1,289,328.

The yield of the fisheries in this region was 65,660,623 pounds, valued at $2,271,726. The fisheries of western Florida were valued at $944,793. Louisiana ranks next in the value of products, the amount being $713,587. The values of the products of the other three States are as follows: Texas $286,610; Mississippi $192,298, and Alabama $134,438. The value of products has decreased $166,949 since 1890. The oyster fishery leads in importance and was valued at $748,760. The sponge fishery ranks next, with a value of $305,589. Mullet follow, valued at $213,988, and red snappers at $200,412. Other important products of the region are trout valued at $114,978; shrimp valued at $117,453, and channel bass valued at $91,776.

The sponge fishery is confined to Florida. The oyster fishery is more important in Louisiana than elsewhere, the yield in that State being valued at $432,668. Mississippi ranks next in the importance of this fishery, the yield being valued at $110,964. The shrimp fishery is of more importance in Louisiana than in any other State, having a value of $80,576. The most important items in the fisheries of Alabama are oysters with a value of $60,207, and red snappers valued at $11,725. In the fisheries of Texas the oyster leads, valued at $94,663. The other Texas fisheries of importance are the trout fishery valued at $45,525, sheepshead at $21,723, and red snapper at $17,453.

The following three tables show, by States, the number of persons employed, the capital invested, and the yield in 1897, while the fourth table shows the extent of the fisheries in 1880, 1890, and 1897:

Table showing the number of persons engaged in the fisheries of the Gulf States in 1897.

States.	Fishermen.	Shoresmen.	Total.
Florida	4,667	344	5,011
Alabama	593	196	789
Mississippi	1,061	1,504	2,565
Louisiana	3,719	684	4,403
Texas	1,140	59	1,199
Total	11,180	2,787	13,967

Table showing the investment in the fisheries of the Gulf States in 1897.

Designation.	Florida.		Alabama.		Mississippi.	
	No.	Value.	No.	Value.	No.	Value.
Vessels	183	$274,177	53	$40,375	83	$81,125
Tonnage	2,771.02		522.18		854.88	
Outfit		191,561		10,570		25,938
Boats	1,621	130,548	254	12,939	439	17,039
Apparatus of capture		54,350		9,205		19,255
Shore property		175,526		49,350		125,644
Cash capital		323,100		42,750		249,300
Total		1,149,262		165,189		518,301

Table showing the investment in the fisheries of the Gulf States in 1897—Continued.

Designation.	Louisiana.		Texas.		Total.	
	No.	Value.	No.	Value.	No.	Value.
Vessels	61	$32, 101	45	$36, 565	425	$464, 343
Tonnage	395. 80	....	508. 81	....	5, 052. 69	....
Outfit	....	9, 545	....	15, 119	....	252, 733
Boats	3, 025	197, 604	686	77, 911	6, 025	436, 041
Apparatus of capture	....	31, 660	....	22, 746	....	137, 216
Shore property	....	173, 903	....	55, 155	....	579, 578
Cash capital	....	69, 000	....	30, 000	....	714, 150
Total	....	513, 813	....	237, 496	....	2, 584, 061

Table showing the products of the fisheries of the Gulf States in 1897.

Species.	Florida.		Alabama.		Mississippi.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Amber-fish	18, 600	$620	....	....	....	....
Angel-fish	59, 186	1, 696	6, 000	$115	....	....
Barracuda	31, 000	1, 240	....	....	....	....
Black bass	....	....	41, 000	2, 870	27, 000	$1, 350
Blue-fish	264, 971	6, 057	204, 500	4, 094	33, 300	1, 105
Buffalo-fish	....	....	....	....	21, 500	215
Cat-fish	5, 000	100	188, 000	2, 872	31, 200	720
Channel bass or red-fish	236, 368	3, 597	213, 000	7, 425	199, 000	8, 303
Crevalle	38, 140	494	12, 000	180	....	....
Drum, salt-water	37, 855	622	6, 000	91	5, 000	250
Flounders	32, 561	549	47, 000	1, 602	28, 200	1, 002
Groupers	781, 155	9, 349	69, 000	1, 035	....	....
Grunts	671, 876	16, 833	....	....	....	....
Hog-fish	81, 600	3, 480	....	....	....	....
Jurel	7, 500	75	....	....	....	....
King-fish	440, 000	6, 600	....	....	....	....
Lady-fish	123, 223	2, 633	....	....	....	....
Mullet, fresh	11, 711, 041	126, 124	591, 300	8, 487	240, 600	2, 881
Mullet, salted	2, 432, 277	54, 928	6, 000	195	....	....
Mullet roe, salted	143, 999	13, 310	....	....	....	....
Perch	....	....	5, 000	200	5, 000	150
Pike and pickerel	....	....	4, 000	61	....	....
Pin-fish	....	....	4, 000	61	38. 880	1, 314
Pompano, fresh	359, 151	17, 964	60, 300	4, 212	24, 800	1, 580
Pompano, salted	23, 225	1, 236	....	....	....	....
Porgies	98, 200	2, 450	....	....	....	....
Pork-fish	11, 962	1, 196	....	....	....	....
Sailor's choice	89, 381	3, 198	....	....	....	....
"Sardines"	150, 000	3, 090	....	....	....	....
Sheepshead	663, 347	9, 793	86, 800	2, 949	110, 150	4, 103
Snappers, red	5, 314, 487	171, 234	335, 000	11, 725	....	....
Snappers, other	110, 631	3, 296	....	....	....	....
Spanish mackerel, fresh	456, 322	21, 757	85, 500	3, 960	64, 760	5, 076
Spanish mackerel, salted	23, 579	1, 193	....	....	....	....
Spots and croakers	26, 113	495	504, 000	8, 099	51, 900	1, 914
Sturgeon	9, 254	331	....	....	....	....
Sun-fishes	7, 909	238	79, 509	2, 783	24, 800	508
Trout, fresh*	703, 830	15, 148	296, 100	9, 711	452, 800	15, 570
Trout, salted	63, 105	2, 524	....	....	....	....
Whiting	9, 589	109	2, 000	70	....	....
Yellow-tail	73, 440	6, 594	....	....	....	....
Other fish	537, 138	24, 317	....	....	....	....
Sponges	332, 856	305, 589	....	....	....	....
Oysters	1, 258, 008	50, 258	1, 785, 438	60, 207	4. 407, 992	110, 964
Clams	7, 084	171	....	....	....	....
Shrimp	....	....	40, 600	609	1, 903, 165	28, 804
Craw-fish	157, 500	3, 150	....	....	....	....
Crabs, hard	6, 240	208	24, 400	505	131, 640	3, 494
Crabs, soft	....	....	....	....	21, 200	1, 720
Turtles	634, 616	22, 736	....	....	....	....
Terrapin	11, 400	1, 250	2, 934	320	6, 798	1, 275
Conchs	500	30	....	....	....	....
Alligator hides	....	12, 450	....	....	....	....
Otter skins	....	14, 481	....	....	....	....
Total	28, 255, 219	944, 793	4, 699, 381	134, 438	7, 829, 685	192, 298

*The "trout" referred to in these tables is the squeteague or weak-fish of the northern Atlantic waters.

Table showing the products of the fisheries of the Gulf States in 1897.

Species.	Louisiana.		Texas.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Amber-fish					18, 600	$620
Angel-fish					65, 186	1, 811
Barracuda					31, 000	1, 240
Black bass	320	$26			68, 320	4, 246
Blue-fish	3, 960	132	29, 540	$1, 281	536, 271	12, 669
Buffalo-fish	311, 093	4, 768	12, 200	470	344, 793	5, 453
Cat-fish	2, 153, 134	51, 420	71, 230	3, 035	2, 448, 564	58, 147
Channel bass or red-fish	465, 200	20, 529	1, 144, 376	51, 922	2, 257, 944	91, 776
Crevalle	18, 000	690	18, 000	743	86, 140	2, 107
Drum, fresh-water	7, 250	74			7, 250	74
Drum, salt-water	18, 570	540	50, 400	2, 046	117, 825	3, 549
Flounders	9, 625	654	218, 025	9, 810	335, 411	13, 626
Groupers			3, 463	84	853, 618	10, 468
Grunts					671, 876	16, 833
Hog-fish	125	5	15, 995	784	97, 720	4, 269
Jew-fish			33, 281	1, 083	33, 281	1, 083
Jurel					7, 500	75
King-fish					140, 000	6, 600
Lady-fish					123, 223	2, 633
Mullet, fresh	165, 819	5, 871	60, 350	2, 167	12, 7[illegible], 110	145, 530
Mullet, salted			500	25	2, 438, 777	55, 148
Mullet roe, salted					143, 999	13, 310
Perch	11, 050	500	32, 150	1, 506	53, 200	2, 356
Pike and pickerel			22, 730	980	26, 730	1, 050
Pin-fish					42, 880	1, 375
Pompano, fresh	17, 665	1, 891	17, 850	812	479, 766	26, 459
Pompano, salted					23, 225	1, 236
Porgies					98, 200	2, 450
Pork-fish					11, 962	1, 196
Sailor's choice					89, 381	3, 198
"Sardines"					150, 000	3, 090
Sheepshead	238, 010	12, 506	467, 504	21, 723	1, 565, 811	51, 074
Shoemaker	9, 600	346			9, 600	346
Silver perch	3, 015	128			3, 015	128
Snappers, red			464, 791	17, 453	6, 114, 278	200, 412
Snappers, other					110, 631	3, 296
Spanish mackerel, fresh	55, 805	5, 132	40, 710	1, 939	703, 097	37, 864
Spanish mackerel, salted					23, 579	1, 193
Spots and croakers	328, 775	16, 980	136, 700	6, 007	1, 047, 488	38, 495
Striped bass	22, 880	1, 449	8, 950	384	31, 830	1, 833
Sturgeon			22, 400	984	31, 654	1, 315
Sun-fishes	119, 780	3, 789			231, 998	7, 318
Trout, fresh	566, 648	26, 500	1, 011, 620	45, 525	3, 030, 998	112, 454
Trout, salted					63, 105	2, 524
Whiting					11, 589	179
Yellow-tail					73, 440	6, 594
Other fish	66, 550	3, 583	60, 500	2, 646	664, 188	30, 546
Sponges					332, 85[illegible]	305, 589
Oysters	6, 714, 330	432, 668	2, 491, 370	94, 663	16, 657, 138	748, 760
Clams					7, 084	171
Shrimp	4, 486, 726	80, 576	360, 530	7, 464	6, 791, 021	117, 453
Craw-fish	84, 950	3, 113			242, 450	6, 263
Crabs, hard	1, 458, 833	12, 891	138, 120	3, 689	1, 759, 233	20, 787
Crabs, soft					21, 200	1, 720
Turtles	22, 395	581	237, 385	6, 860	894, 396	30, 177
Terrapin	41, 680	4, 149	3, 880	507	66, 692	7, 501
Conchs					500	30
Alligator hides		22, 096				34, 546
Otter skins						14, 481
Total	17, 401, 788	713, 587	7, 174, 550	286, 610	65, 660, 623	2, 271, 726

Comparative table showing the extent of the fisheries of the Gulf States in 1880, 1890, and 1897.

PERSONS EMPLOYED.

States.	1880.	1890.	1897.	Increase or decrease in 1897 compared with 1890.	Percentage of increase or decrease in 1897 compared with 1890.
Florida	2,112	4,068	5,011	+ 943	+ 2.32
Alabama	635	618	789	+ 171	+27.66
Mississippi	186	1,721	2,565	+ 844	+49.04
Louisiana	1,597	4,068	4,403	+ 335	+ 8.23
Texas	601	1,277	1,199	— 78	— 6.11
Total	5,131	11,752	13,967	+2,215	+18.85

CAPITAL INVESTED.

States.	1880.	1890.	1897.	Increase or decrease in 1897 compared with 1890.	Percentage of increase or decrease in 1897 compared with 1890.
Florida	$362,563	$1,269,294	$1,149,262	—$220,032	—16.07
Alabama	38,200	135,290	165,189	+ 29,899	+22.10
Mississippi	8,800	434,710	518,301	+ 83,591	+19.23
Louisiana	93,621	719,876	513,813	— 206,063	—28.62
Texas	42,400	319,122	237,496	— 81,626	—25.58
Total	545,584	2,978,292	2,584,061	— 394,231	—13.24

PRODUCTS.

States.	Pounds.				Percentage of increase or decrease in 1897 compared with 1890.
	1880.	1890.	1897.	Increase or decrease in 1897 compared with 1890.	
Florida	8,376,335	27,418,562	28,255,219	+ 836,657	+ 3.42
Alabama	3,541,500	4,776,968	4,699,381	— 77,587	— 1.62
Mississippi	788,500	8,131,401	7,829,685	— 301,716	— 3.71
Louisiana	6,996,000	20,789,203	17,401,788	—3,387,415	—16.29
Texas	3,858,875	7,959,400	7,174,550	— 784,850	— 9.86
Total	23,561,210	69,075,534	65,360,623	—3,714,911	— 5.38

States.	Value.				
	1880.	1890.	1897.	Increase or decrease in 1897 compared with 1890.	Percentage of increase or decrease in 1897 compared with 1890.
Florida	$564,819	$1,064,139	$944,793	—$119,346	—11.21
Alabama	119,275	154,871	134,438	— 20,433	—13.19
Mississippi	22,540	245,699	192,298	— 53,401	—21.73
Louisiana	392,610	660,134	713,587	+ 53,453	+ 8.10
Texas	128,300	313,832	286,610	— 27,222	— 8.67
Total	1,227,544	2,438,675	2,271,726	—166,949	— 6.85

FISHERIES OF WESTERN FLORIDA.

The fisheries of western Florida are, in general, more important than those of any other State on the Gulf, and especially take precedence in the yield of blue-fish, mullet, pompano, red snappers, Spanish mackerel, and turtles. This is the only State in the country in which the sponge fishery is prosecuted.

The length of the coast line of the west side of Florida, following indentations, is about 2,810 miles.

The principal indentations are Charlotte Harbor, Sarasota Bay, Tampa Bay, Clearwater Bay, Wiccassassee Bay, Apalachee Bay, St. George Sound, Apalachicola Bay, St. Andrew Bay, Choctawhatchee Bay, Santa Rosa Sound, Escambia Bay, and Perdido Bay. The more important rivers are the Caloosahatchee, Peace, Manatee, Withlacoochee, Suwannee, Ocklocknee, Apalachicola, Choctawhatchee, Escambia, and Perdido.

The fishery centers are Key West, St. James City, Punta Gorda, St. Petersburg, Tampa, Tarpon Springs, Homosassa, Cedar Key, St. Marks, Carrabelle, Apalachicola, St. Andrew Bay, and Pensacola.

In all respects except the amount of capital invested and the value of the catch there has been an increase over the figures of the last general canvass in 1890.

The three following tables give, in condensed form, statistics of the fisheries of the west coast of Florida. Information for all species was not collected for the year 1897, and in some instances the figures obtained for the year 1895 have been used.

There were 1,231 men engaged in the vessel fisheries and in transporting fishery products. There were 183 vessels, valued at $465,738, including their outfits, used in transporting and in the fisheries. The fishing vessels had $5,632 invested in apparatus.

In the shore fisheries there were engaged 3,436 men. The boats numbered 1,621 and were worth $130,548. The apparatus of capture was valued at $48,718. In the shore industries connected with the fishing business 344 persons were employed. The shore property and cash capital amounted to $498,626. The total investment in the fisheries was $1,149,262.

The total yield of the commercial fisheries was 28,255,219 pounds, valued at $944,793. The three most valuable products were sponges, valued at $305,589; mullet, worth $194,362; and red snappers, worth $171,234.

Persons employed.

How engaged.	No.
On vessels fishing	1,169
On vessels transporting	62
In shore or boat fisheries	3,436
Shoresmen	344
Total	5,011

Table of apparatus and capital.

Items.	No.	Value.
Vessels fishing	154	$241, 201
Tonnage	2, 502. 32	
Outfit		179, 259
Vessels transporting	29	32, 976
Tonnage	268. 70	
Outfit		12, 302
Boats	1, 621	130, 548
Apparatus—vessel fisheries:		
Seines	3	675
Turtle gill nets	54	1, 692
Lines		1, 007
Tongs	16	136
Sponge apparatus		2, 122
Apparatus—shore fisheries:		
Seines	271	$16, 287
Gill nets	858	22, 998
Cast nets	28	190
Trap nets	25	75
Turtle gill nets	61	1, 586
Lines		184
Tongs	207	1, 575
Sponge apparatus		1, 134
Guns	297	4, 455
Traps	202	122
Minor apparatus		112
Shore and accessory property		175, 526
Cash capital		323, 100
Total		1, 149, 262

Table showing by species the yield of the fisheries of the west coast of Florida in 1897.

Species.	Lbs.	Value.
Angel-fish	59, 186	$1, 696
Amber-fish	18, 600	620
Barracuda	31, 000	1, 240
Blue-fish	264, 971	6, 057
Cat-fish	5, 000	100
Channel bass	236, 368	3, 597
Crevalle	38, 140	494
Drum	37, 855	622
Flounders	32, 561	549
Groupers	781, 155	9, 349
Grunts	671, 876	16, 833
Hog-fish	81, 600	3, 480
Jurel	7, 500	75
King-fish	440, 000	6, 600
Lady-fish	123, 223	2, 633
Mullet, fresh	11, 639, 615	125, 172
Mullet, salted	2, 503, 703	55, 880
Mullet roe, salted	143, 999	13, 310
Pompano, fresh	359, 151	17, 964
Pompano, salted	23, 225	1, 236
Porgies	98, 200	2, 450
Pork-fish	11, 962	1, 196
Sailor's choice	89, 381	3, 198
Sardines	150, 000	3, 090
Sheepshead	663, 347	9, 793
Snappers, red	5, 314, 487	$171, 234
Snappers, other	110, 631	3, 296
Spanish mackerel, fresh	456, 322	21, 757
Spanish mackerel, salted	23, 579	1, 193
Spots and croakers	26, 113	495
Sturgeon	9, 254	331
Sun-fishes	7, 909	238
Trout, fresh	703, 830	15, 148
Trout, salted	63, 105	2, 524
Whiting	9, 589	109
Yellow-tail	73, 440	6, 594
Other fish	537, 138	24, 317
Oysters	[1] 1, 258, 008	50, 258
Clams	7, 084	171
Conchs	500	30
Sponge	332, 856	305, 589
Crabs	6, 240	208
Craw-fish	157, 500	3, 150
Turtles	634, 616	22, 736
Terrapins	[2] 11, 400	1, 250
Alligator hides	([3])	12, 450
Otter skins	([4])	14, 481
Total	28, 255, 219	944, 793

[1] 179,715 bushels.

[2] 3,800 in number.

[3] 17,300 in number.

[4] 2,936 in number.

THE FISHERIES BY COUNTIES.

Commercial fishing is carried on in 16 of the 19 coastal counties, but most extensively in Monroe, Escambia, and Hillsboro counties.

Vessel fisheries.—The vessel fisheries of the west coast of Florida are more important than those of any other State in this region. They are prosecuted from 8 counties, but principally from Monroe and Escambia counties. In the former the sponge and turtle fisheries are most prominent, while in the latter the red-snapper fishery occupies the leading position. The total vessel catch amounted to 7,221,987 pounds, valued at $488,531. The more important of the products are sponges, valued at $276,295; red snappers, $161,999; oysters, $17,144, and turtles, $16,308. While the shore fisheries yielded a larger quantity of fishery products, the value of the vessel fisheries was greater.

Shore fisheries.—The total yield of the shore fisheries was 21,033,232 pounds, valued at $456,262. While this is a much larger catch than that made in the vessel fisheries, the latter is somewhat more valuable, owing to the large number of sponges taken by vessels. The leading products in the shore fisheries are mullet, worth $194,362; oysters, $33,114; sponges, $29,294; pompano, $18,997; trout, $17,672; grunts, $16,833, and Spanish mackerel, $15,836.

Monroe County ranks first in the value of products handled, followed by Hillsboro, Manatee, Lee, Franklin, and De Soto counties in the order named. In the quantity of catch handled Manatee County holds first place, followed by Hillsboro, De Soto, Monroe, and Franklin counties.

Detailed figures for each county are given in the following five tables:

Table showing the number of persons employed in the fisheries of the west coast of Florida.

Counties.	In vessel fisheries.	On vessels transporting.	Shore or boat fisheries.	Shoresmen.	Total.
Monroe	728	5	783	85	1,601
Lee			267	9	276
De Soto	15	12	228	24	279
Manatee			183	9	192
Hillsboro	127	41	340	30	538
Hernando			22	2	24
Citrus			55	6	61
Levy	3		235	9	247
Lafayette			25	2	27
Taylor			146	3	149
Wakulla			124	12	136
Franklin	61	4	580	116	761
Calhoun			20	1	21
Washington	9		192	10	211
Santa Rosa	6		10		16
Escambia	220		226	26	472
Total	1,169	62	3,436	344	5,011

Table showing by counties the apparatus and capital employed in the fisheries of the west coast of Florida.

Designation.	Monroe.		Lee.		De Soto.		Manatee.		Hillsboro.		Hernando	
	No.	Value.	No.	Val.	No.	Val.	No.	Val.	No.	Val.	No.	Val.
Vessels fishing	89	$121,800			2	$1,600			15	$18,206		
Tonnage	1,165.45				13.79				181.93			
Outfit		79,594				1,539				13,604		
Vessels transporting	1	1,600			6	3,600			20	26,926		
Tonnage	19.14				47.52				189.29			
Outfit		225				2,922				8,995		
Boats	343	52,942	54	$3,106	123	6,915	199	$12,530	222	13,185	20	$600
Apparatus—vessel fisheries:												
Seines					2	550						
Turtle nets	51	1,632										
Lines		18								130		
Sponge apparatus		1,702								318		
Apparatus—shore fisheries:												
Seines	10	154	43	2,170			78	2,350	45	1,842		
Gill nets	4	48	56	1,771	140	3,500	211	6,219	133	3,950	20	600
Cast nets	8	80							20	110		
Trap nets	25	75										
Turtle nets	28	896										
Lines		89								30		
Tongs					9	59	6	48	48	312		
Sponge apparatus		1,026								9		
Guns			150	2,250	44	660			20	300		
Traps			150	90	15	9			20	12		
Minor apparatus		108										
Shore and accessory property		72,305		2,100		1,200		1,100		20,555		50
Cash capital		135,000		500		15,600				50,000		
Total		469,294		11,987		38,154		22,247		158,484		1,250

Table showing by counties the apparatus and capital employed in the fisheries of the west coast of Florida—Continued.

Desiguation.	Citrus.		Levy.		Lafayette.		Taylor.		Wakulla.		Franklin.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	.....	....	1	$700	.....	....	.....	....	....	....	10	$6,020
Tonnage	.....	....	8.15	....	.....	....	.....	....	....	....	72.32	....
Outfit	.....	....	......	1,980	.....	....	.....	....	....	....	....	6,182
Vessels transporting	.....	....	......	......	.....	....	.....	....	....	....	2	850
Tonnage	.....	....	......	......	.....	....	.....	....	....	....	12.75	....
Outfit	.....	....	......	......	.....	....	.....	....	....	....	....	160
Boats	46	$1,090	109	8,029	14	$420	57	$1,710	81	$2,935	213	19,216
Apparatus—vessel fisheries:												
Turtle nets	.....	....	3	60	.....	....	.....	....	....	....	....	....
Tongs	.....	....	......	......	.....	....	.....	....	....	....	16	136
Sponge apparatus	.....	....	......	......	.....	....	.....	....	....	....	....	102
Apparatus—shore fisheries:												
Seines	.....	....	......	......	.....	....	.....	....	8	240	35	2,531
Gill nets	23	690	62	1,340	14	350	57	1,425	51	765	64	1,465
Turtle nets	.....	....	30	600	.....	....	.....	....	....	....	3	90
Lines	.....	....	......	3	.....	....	.....	....	....	....	....	36
Tongs	18	144	26	156	.....	....	.....	....	4	32	65	553
Sponge apparatus	.....	....	......	......	.....	....	.....	....	....	....	....	99
Guns	.....	....	......	......	.....	....	.....	....	50	750	33	495
Traps	.....	....	......	......	.....	....	.....	....	....	....	17	11
Minor apparatus	.....	....	......	4	.....	....	.....	....	....	....	....	....
Shore and accessory property	.....	430	......	2,100	.....	100	.....	280	....	1,118	....	28,138
Cash capital	.....	....	......	8,500	.....	....	.....	....	....	3,000	....	38,500
Total	.....	2,354	......	23,472	.....	870	.....	3,415	....	8,840	....	104,584

Designation.	Calhoun.		Washington.		Santa Rosa.		Escambia.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	......	....	2	$1,900	1	$1,200	34	$89,775	154	$241,201
Tonnage	......	....	14.71	....	13.29	....	1,032.68	....	2,502.32	....
Outfit	......	....	......	2,280	......	1,440	....	72,640	....	179,259
Vessels transporting	......	....	......	....	......	....	....	....	29	32,976
Tonnage	......	....	......	....	......	....	....	....	268.70	....
Outfit	......	....	......	....	......	....	....	....	....	12,302
Boats	12	$360	73	2,410	2	200	53	4,900	1,621	130,548
Apparatus—vessel fisheries:										
Seines	......	....	1	125	......	....	....	....	3	675
Turtle nets	......	....	......	....	......	....	....	....	54	1,692
Lines	......	....	......	33	......	22	....	804	....	1,007
Tongs	......	....	......	....	......	....	....	....	16	136
Sponge apparatus	......	....	......	....	......	....	....	....	....	2,122
Apparatus—shore fisheries:										
Seines	4	400	28	4,100	2	250	18	2,250	271	16,287
Gill nets	......	....	3	75	......	....	20	800	858	22,998
Cast nets	......	....	......	....	......	....	....	....	28	190
Trap nets	......	....	......	....	......	....	....	....	25	75
Turtle nets	......	....	......	....	......	....	....	....	61	1,586
Lines	......	....	......	....	......	....	....	26	....	184
Tongs	......	....	16	136	......	....	15	135	207	1,575
Sponge apparatus	......	....	......	....	......	....	....	....	....	1,134
Guns	......	....	......	....	......	....	....	....	297	4,455
Traps	......	....	......	....	......	....	....	....	202	122
Minor apparatus	......	....	......	....	......	....	....	....	....	112
Shore and accessory property	......	50	......	3,100	......	100	....	42,800	....	175,526
Cash capital	......	....	......	2,000	......	....	....	70,000	....	323,100
Total	......	810	......	16,159	......	3,212	....	284,130	....	1,149,262

Table showing by counties and species the yield of the fisheries of western Florida.

Species.	Monroe.		Lee.		De Soto.		Manatee.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Angel-fish	27, 600	$1, 280	2, 000	$25				
Amber-fish	18, 600	620						
Barracuda	31, 000	1, 240						
Blue-fish	11, 000	917	13, 500	270	33, 582	$672	45, 000	$900
Channel bass			21, 000	315	4, 800	72	75, 620	1, 134
Crevalle							8, 094	122
Drum							15, 000	225
Flounders	155	16					12, 000	184
Groupers	114, 500	2, 683						
Grunts	642, 000	16, 250					9, 333	187
Hog-fish	81, 600	3, 480						
King-fish	440, 000	6, 600						
Lady-fish	70, 000	2, 100						
Mullet, fresh	49, 614	1, 443	211, 100	3, 167	2, 362, 080	23, 621	3, 664, 566	36, 645
Mullet, salted	750	15	745, 444	12, 528			31, 000	517
Mullet roe, salted	100	10	51, 904	4, 152			2, 675	216
Pompano, fresh			12, 600	756	58, 240	2, 330	76, 110	3, 805
Pompano, salted			7, 425	446				
Porgies	98, 200	2, 450						
Pork-fish	11, 962	1, 196						
Sailor's choice	20, 179	2, 020	2, 100	32	2, 000	40	15, 102	226
"Sardines"	150, 000	3, 090						
Sheepshead	300	14	73, 142	1, 097	100, 000	1, 500	81, 213	1, 219
Snappers, red	6, 800	204						
Snappers, other	59, 334	2, 416	1, 000	15			11, 000	165
Spanish mackerel, fresh	17, 000	569	2, 000	80	207, 720	12, 509	29, 716	1, 189
Spanish mackerel, salted			3, 500	245				
Trout, fresh			24, 333	487	5, 453	119	117, 425	2, 347
Yellow-tail	64, 880	6, 475						
Other fish	453, 481	23, 304						
Oysters					67, 128	2, 797	1, 280	79
Clams	900	36						
Conchs	500	30						
Sponges	270, 906	277, 197						
Crabs	6, 240	208						
Craw-fish	157, 500	3, 150						
Turtles	546, 752	17, 770						
Alligator hides				8, 400		525		
Otter skins				10, 000		1, 750		
Total	3, 351, 853	376, 783	1, 171, 048	42, 025	2, 841, 003	45, 935	4, 195, 134	49, 160

Species.	Hillsboro.		Hernando.		Citrus.		Levy.		Lafayette.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Angel-fish	15, 100	$200								
Blue-fish	31, 114	673					1, 800	$45		
Channel bass	61, 307	970	1, 500	$23			3, 640	55		
Crevalle	12, 515	188								
Drum	13, 000	200					9, 855	197		
Flounders	18, 444	277								
Groupers	127, 000	1, 270								
Grunts	17, 333	347								
Mullet, fresh	1, 778, 631	17, 058	128, 000	1, 300	74, 110	$741	625, 000	6, 250	143, 000	$1, 430
Mullet, salted	45, 122	529	3, 000	31			18, 200	223	24. 000	360
Mullet roe, salted	1, 840	184	120	12					2, 000	200
Pompano, fresh	170, 756	8, 753								
Sailor's choice	24, 000	360					26, 000	520		
Sheepshead	138, 995	2, 128	6, 213	93	22, 200	334	130, 896	1, 366	3, 100	62
Snappers, red	275, 500	8, 290					7, 500	225		
Snappers, other	22, 433	362	1, 000	20	6, 333	127	9, 531	191		
Spanish mackerel, fresh	75, 834	3, 630					1, 214	61		
Spanish mackerel, salted					8, 946	447				
Spots and croakers							1, 109	22		
Sturgeon							9, 254	331		
Trout, fresh	110, 220	2, 311	33, 666	673	12, 000	270	140, 000	3, 563	14, 000	420
Whiting							600	12		
Other fish	4, 100	78					310	6		
Oysters	313, 500	17, 219			7, 000	199	59, 500	2, 040		
Clams							6, 184	135		
Sponges	56, 000	23, 300								
Turtles							85, 000	4, 800		
Terrapins							11, 400	1, 250		
Alligator hides		3, 000								
Otter skins		2, 000								
Total	3, 312, 744	93, 327	173, 499	2, 152	130, 589	2, 118	1, 146, 993	21, 292	186, 100	2, 472

Table showing by counties and species the yield of the fisheries of western Florida—Cont'd.

Species.	Taylor.		Wakulla.		Franklin.		Calhoun.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Catfish					5, 000	$100		
Channel bass	1, 600	$24	29, 681	$446	29, 977	450		
Flounders			500	9				
Grunts			3, 210	49				
Mullet, fresh	901, 000	11, 263	646, 914	9, 114	296, 500	2, 866	8, 000	$120
Mullet, salted	114, 600	2, 292	125, 661	2, 513	801, 500	19, 650	97, 000	2, 425
Mullet roe, salted	12, 000	1, 200	7, 900	790	29, 160	2, 916	4, 000	400
Pompano, fresh			630	32	6, 100	183		
Pompano, salted							2, 000	100
Sheepshead			9, 157	138	46, 670	850		
Spanish mackerel, fresh			3, 278	163	13, 600	385		
Spanish mackerel, salted							2, 300	104
Spots and croakers			1, 109	18	2, 900	68		
Trout, fresh			17, 995	448	194, 800	3, 322		
Trout, salted							12, 000	480
Whiting					1, 300	20		
Oysters			11, 100	370	742, 500	25, 144		
Sponges					5, 950	5, 092		
Turtles					2, 144	150		
Alligator hides				240		285		
Otter skins				18		713		
Total	1, 029, 200	14, 779	857, 135	14, 348	2, 178, 101	62, 194	125, 300	3, 629

Species.	Washington.		Santa Rosa.		Escambia.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Angel-fish					14, 486	$181	59, 186	$1, 696
Amber-fish							18, 600	620
Barracuda							31, 000	1, 240
Blue-fish	21, 250	$425	8, 725	$175	99, 000	1, 980	264, 971	6, 057
Cat-fish							5, 000	100
Channel bass	1, 810	28	2, 100	32	3, 333	48	236, 368	3, 597
Crevalle	2, 266	29	1, 100	17	14, 165	138	38, 140	494
Drum							37, 855	622
Flounders	403	16	325	13	734	34	32, 561	549
Groupers	17, 805	178	8, 500	85	513, 350	5, 133	781, 155	9, 349
Grunts							671, 876	16, 833
Hog-fish							81, 600	3, 480
Jurel					7, 500	75	7, 500	75
King-fish							440, 000	6, 600
Lady-fish	29, 268	293	1, 300	13	22, 655	227	123, 223	2, 633
Mullet, fresh	115, 000	1, 672	53, 000	707	583, 100	7, 775	11,639,915	125, 172
Mullet, salted	426, 000	13, 845			71, 426	952	2, 503, 703	55, 880
Mullet roe, salted	32, 300	3, 230					143, 999	13, 310
Pompano, fresh	16, 215	935	6, 500	390	12, 000	780	359, 151	17, 964
Pompano, salted	13, 800	690					23, 225	1, 236
Porgies							98, 200	2, 450
Pork-fish							11, 962	1, 196
Sailor's choice							89, 381	3, 198
"Sardines"							150, 000	3, 090
Sheepshead	6, 424	128	7, 145	143	37, 892	721	663, 347	9, 793
Snappers, red	102, 019	3, 370	61, 555	2, 154	4, 861, 113	156, 991	5, 314, 487	171, 234
Snappers, other							110, 631	3, 296
Spanish mackerel, fresh	37, 525	1, 118	28, 333	850	40, 102	1, 203	456, 322	21, 757
Spanish mackerel, salted	8, 833	397					23, 579	1, 193
Spots and croakers			1, 300	20	19, 695	367	26, 113	495
Sturgeon							9, 254	331
Sun-fishes	729	15			7, 180	223	7, 909	238
Trout, fresh	2, 000	70	2, 100	74	29, 838	1, 044	703, 830	15, 148
Trout, salted	51, 105	2, 044					63, 105	2, 524
Whiting					7, 689	77	9, 589	109
Yellow-tail					8, 560	119	73, 440	6, 594
Other fish	21, 083	216	814	12	57, 350	701	537, 138	24, 317
Oysters	21, 000	910			35, 000	1, 500	1, 258, 008	50, 258
Clams							7, 084	171
Conchs							500	30
Sponges							332, 856	305, 589
Crabs							6, 240	208
Craw-fish							157, 500	3, 150
Turtles					720	16	634, 616	22, 736
Terrapins							11, 400	1, 250
Alligator hides								12, 450
Otter skins								14, 481
Total	926, 835	29, 609	182, 797	4, 685	6, 446, 888	180, 285	28,255,219	944, 793

FISHERIES BY APPARATUS.

Vessel fisheries.—In the vessel fisheries of western Florida purse and haul seines, lines, turtle nets, sponge apparatus, and tongs were the only forms of apparatus in use. Much the largest catch was made with lines—5,840,642 pounds, valued at $171,229, being secured. Of the line catch 5,032,487 pounds, worth $161,999, consisted of red snappers; the other species were groupers and king-fish.

The most valuable products were obtained by the sponge apparatus, 302,101 pounds of sponges, worth $276,295, being secured. Oysters and turtles were taken with tongs and turtle nets, respectively; the value of the former was $17,144, and of the latter $16,308.

Purse seines were used in Biscayne Bay on the eastern coast for Spanish mackerel alone, and 70,000 pounds, valued at $7,000, were obtained.

Haul seines, which were used incidentally by several red-snapper vessels, occupy an insignificant position, as their catch was only 26,392 pounds, valued at $555.

The total yield from all forms of apparatus was 7,221,987 pounds, valued at $488,531.

Shore fisheries.—Gill nets are the most important means of capture in the shore or boat fisheries. With this form of apparatus 11,847,155 pounds of fish, worth $164,971, were secured. Mullet is by far the most important fish taken, while the other prominent species were the pompano, Spanish mackerel, trout, and sheepshead.

The seine catch is less than half that of the gill nets, but has a higher proportionate value. The total is 5,956,891 pounds, worth $115,993. The principal species taken is the mullet, as is the case with gill nets; other prominent species are Spanish mackerel, trout, and pompano, although these occupy an insignificant position as compared with the mullet.

The line fishery comes next in importance, yielding 2,081,971 pounds, valued at $72,443. The greater part of this fishery was carried on in Monroe County. The leading species are grunts, red snappers, and yellow-tail.

Cast nets, turtle nets, trap nets, sponge apparatus, tongs, hooks, guns, etc., are credited with taking 1,147,215 pounds, valued at $102,855. The prominent species taken by these forms of apparatus are mullet, oysters, sponges, alligators, and otters.

In 1897 an act was passed by the legislature prohibiting the use of "stop nets." For some years the fishermen have been in the habit of operating with this net, which is an ordinary seine or gill net, by stretching it across the mouths of small bights, creeks, and rivers along the coast and holding it in position by means of stakes driven in the bottom. This net, set at high water, when the fish had run in, would prevent them from running out again with the tide, and they could be easily caught by the fishermen at low water. This fishery was mainly for mullet. The method was very destructive, as young and old, large and small, were taken, or else left to die on the bare bottom, and the enactment of this law will doubtless greatly benefit the fisheries.

Table showing by counties and apparatus the yield of the vessel fisheries of the west coast of Florida.

Apparatus and species.	Monroe.		De Soto.		Hillsboro.		Levy.		Franklin.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Purse seines:										
Spanish mackerel	....	....	70, 000	$7, 000	....	....	....	....	....	....
Lines:										
Groupers	8, 500	$249	....	....	81, 000	$810	....	....	....	....
King-fish	197, 000	2, 955	....	....	....	....	....	....	....	....
Red snappers....	5, 800	174	....	....	152, 000	4, 560	....	....	....	....
Total	211, 300	3, 378	....	....	233, 000	5, 370	....	....	....	....
Turtle nets:										
Turtles	489, 852	15, 658	....	....	....	....	13, 000	$650	....	....
Sponge apparatus:										
Sponges	247, 006	252, 377	....	....	51, 645	20, 576	....	....	3, 450	$3, 342
Tongs:										
Oysters	....	....	....	....	....	....	....	....	480, 000	17, 144
Grand total..	948, 158	271, 413	70, 000	7, 000	284, 645	25, 946	13, 000	650	483, 450	20, 486

Apparatus and species.	Washington.		Santa Rosa.		Escambia.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Purse seines:								
Spanish mackerel	....	....	....	....	....	....	70, 000	$7, 000
Haul seines:								
Blue-fish	4, 350	$87	....	....	....	....	4, 350	87
Jurel	....	....	....	....	7, 500	$75	7, 500	75
Lady-fish	3, 212	32	....	....	....	....	3, 212	32
Pompano	3, 515	203	....	....	....	....	3, 515	203
Spanish mackerel	4, 075	114	....	....	....	....	4, 075	114
Spots	....	....	....	....	2, 340	30	2, 340	30
Yellow-tail	....	....	....	....	1, 400	14	1, 400	14
Total	15, 152	436	....	....	11, 240	119	26, 392	555
Lines:								
Groupers	17, 805	178	8, 500	$35	495, 350	4, 953	611, 155	6, 275
King-fish	....	....	....	....	....	....	197, 000	2, 955
Red snappers....	102, 019	3, 370	61, 555	2, 154	4, 711, 113	151, 741	5, 032, 487	161, 999
Total	119, 824	3, 548	70, 055	2, 239	5, 206, 463	156, 694	5, 840, 642	171, 229
Turtle nets:								
Turtles	....	....	....	....	....	....	502, 852	16, 308
Sponge apparatus:								
Sponges	....	....	....	....	....	....	302, 101	276, 295
Tongs:								
Oysters	....	....	....	....	....	....	480, 000	17, 144
Grand total..	134, 976	3, 984	70, 055	2, 239	5, 217, 703	156, 813	7, 221, 987	488, 531

Table showing by counties and apparatus the yield of the shore fisheries of the west coast of Florida.

Apparatus and species.	Monroe.		Lee.		De Soto.		Manatee.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Blue-fish..........	3, 000	$250	....	....	....	....	21, 000	$420
Channel bass	....	....	....	....	....	....	40, 005	600
Crevalle	....	....	....	....	....	....	1, 500	23
Drum..................	....	....	....	....	....	....	15, 000	225
Groupers	13, 000	264	....	....	....	....	....	....
Grunts	38, 000	950	....	....	....	....	3, 333	67
Lady-fish	70, 000	2, 100	....	....	....	....	....	....
Mullet, fresh	9, 014	225	123, 000	$1, 845	....	....	1, 245, 545	12, 455
Mullet, salted..........	....	....	714, 233	11, 904	....	....	21, 000	350
Mullet roe, salted......	....	....	51, 104	4, 088	....	....	1, 800	146
Pompano, fresh........	....	....	....	....	....	....	4, 888	244
Porgies................	1, 000	20	....	....	....	....	....	....
Pork-fish	500	50	....	....	....	....	....	....
"Sardines"	132, 000	2, 640	....	....	....	....	....	....
Sheepshead............	300	14	....	....	....	....	23, 113	347
Snappers, gray, etc....	11, 000	367	....	....	....	....	....	....
Spanish mackerel, fresh	5, 000	169	....	....	....	....	8, 000	320

Table showing by counties and apparatus the yield of the shore fisheries of the west coast of Florida—Continued.

Apparatus and species.	Monroe.		Lee.		De Soto.		Manatee.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines—Continued.								
Trout, fresh							13, 425	$267
Yellow-tail	200	$7						
Other fish	9, 800	245						
Craw-fish	132, 000	2, 640						
Total	424, 814	9, 941	888, 337	$17, 837			1, 398, 609	15, 464
Gill nets:								
Angel-fish			2, 000	35				
Blue-fish			13, 500	270	33, 582	$672	24, 000	480
Channel bass			21, 000	315	4, 800	72	35, 615	534
Crevalle							6, 594	99
Flounders							12, 000	184
Grunts							6, 000	120
Mullet, fresh	33, 500	1, 005	88, 100	1, 322	2, 362, 080	23, 621	2, 419, 021	24, 190
Mullet, salted			31, 211	624			10, 000	167
Mullet roe, salted			800	64			875	70
Pompano, fresh			12, 600	756	58, 240	2, 330	71, 222	3, 561
Pompano, salted			7, 425	446				
Sailor's choice			2, 100	32	2, 000	40	15, 102	226
Sheepshead			73, 142	1, 097	100, 000	1, 500	58, 100	872
Snappers, gray, etc			1, 000	15			11, 000	165
Spanish mackerel, fresh			2, 000	80	137, 720	5, 509	21, 716	869
Spanish mackerel, salt			3, 500	245				
Trout, fresh			24, 333	487	5, 453	119	104, 000	2, 080
Total	33, 500	1, 005	282, 711	5, 788	2, 703, 875	33, 863	2, 795, 245	33, 617
Cast nets:								
Mullet, fresh	7, 100	213						
Mullet, salted	750	15						
Mullet roe, salted	100	10						
Sardines	18, 000	450						
Total	25, 950	688						
Turtle nets:								
Turtles	56, 900	2, 112						
Lines:								
Amber-fish	18, 600	620						
Angel-fish	22, 000	1, 038						
Barracuda	31, 000	1, 240						
Blue-fish	8, 000	667						
Flounders	155	16						
Groupers	81, 000	1, 890						
Grunts	573, 000	14, 525						
Hog-fish	74, 750	3, 185						
King-fish	243, 000	3, 645						
Porgies	91, 800	2, 295						
Pork-fish	9, 462	946						
Sailor's choice	19, 066	1, 907						
Snappers, red	1, 000	30						
Snappers, other	37, 070	1, 610						
Spanish mackerel	12, 000	400						
Yellow-tail	59, 133	5, 913						
Other fish	427, 721	22, 186						
Total	1, 708, 757	62, 113						
Miscellaneous:								
Angel-fish	5, 600	242						
Groupers	12, 000	280						
Grunts	31, 000	775						
Hog-fish	6, 850	295						
Porgies	5, 400	135						
Pork-fish	2, 000	200						
Sailor's choice	1, 113	113						
Snappers, gray, etc	11, 264	439						
Yellow-tail	5, 547	555						
Other fish	15, 960	873						
Sponges	23, 900	24, 820						
Crabs	6, 240	208						
Craw-fish	25, 500	510						
Clams	900	36						
Conchs	500	30						
Oysters					67, 128	2, 797	1, 280	79
Alligator hides				8, 400		525		
Otter skins				10, 000		1, 750		
Total	153, 774	29, 511		18, 400	67, 128	5, 072	1, 280	79
Grand total	2, 403, 695	105, 370	1, 171, 048	42, 025	2, 771, 003	38, 935	4, 195, 134	49, 160

Table showing by counties and apparatus the yield of the shore fisheries of the west coast of Florida—Continued.

Apparatus and species.	Hillsboro.		Hernando.		Citrus.		Levy.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Channel bass	15, 203	$228						
Crevalle	4, 515	68						
Drum	13, 000	200						
Flounders	6, 000	90						
Mullet, fresh	92, 266	836						
Mullet, salted	9, 667	106						
Mullet roe, salted	1, 000	100						
Sailor's choice	2, 000	30						
Sheepshead	25, 635	430						
Snappers, gray, etc	5, 100	102						
Trout, fresh	11, 666	234						
Other fish	3, 000	45						
Total	189, 052	2, 469						
Gill nets:								
Angel-fish	15, 100	200						
Blue-fish	31, 114	673					1, 800	$45
Channel bass	46, 104	742	1, 500	$23			3, 640	55
Crevalle	8, 000	120						
Drum							9, 855	197
Flounders	12, 444	187						
Grunts	17, 333	347						
Mullet, fresh	1, 652, 365	15, 882	128, 000	1, 300	74, 110	$741	625, 000	6, 250
Mullet, salted	35, 455	423	3, 000	31			18, 200	223
Mullet roe, salted	840	84	120	12				
Pompano, fresh	170, 756	8, 753						
Sailor's choice	22, 000	330					26, 000	520
Sheepshead	113, 360	1, 698	6, 213	93	22, 200	334	119, 782	1, 198
Snappers, gray, etc	17, 333	260	1, 000	20	6, 333	127	9, 531	191
Spanish mackerel, fresh	75, 834	3, 630					1, 214	61
Spanish mackerel, salted					8, 946	447		
Spots and croakers							1, 109	22
Sturgeon							9, 254	331
Trout, fresh	98, 554	2.077	33, 666	673	12, 000	270	140, 000	3, 563
Whiting							600	12
Other fish	1, 100	33					310	6
Total	2, 317, 692	35, 439	173, 499	2, 152	123, 589	1, 919	966, 295	12, 674
Cast nets:								
Mullet, fresh	34, 000	340						
Turtle nets:								
Turtles							72, 000	4, 150
Lines:								
Groupers	46, 000	460						
Sheepshead							11, 114	168
Snappers, red	123, 500	3, 730					7, 500	225
Total	169, 500	4, 190					18, 614	393
Miscellaneous:								
Sponges	4, 355	2, 724						
Clams							6, 184	135
Oysters	313, 500	17, 219			7, 000	199	59, 500	2, 040
Terrapins							11, 400	1, 250
Alligator hides		3, 000						
Otter skins		2, 000						
Total	317, 855	24, 943			7, 000	199	77, 084	3, 425
Grand total	3, 028, 099	67, 381	173, 499	2, 152	130, 589	2, 118	1, 133, 993	20, 642

Table showing by counties and apparatus the yield of the shore fisheries of the west coast of Florida—Continued.

Apparatus and species.	Lafayette.		Taylor.		Wakulla.		Franklin.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Channel bass	....	....	....	....	8, 443	$127	26, 977	$405
Flounders	....	....	....	....	500	9	....	....
Mullet, fresh	....	....	....	....	51, 500	773	143, 500	1, 436
Mullet, salted	....	....	....	....	49, 245	985	616, 500	15, 330
Mullet roe, salted	....	....	....	....	1, 800	180	20, 660	2, 066
Pompano, fresh	....	....	....	....	....	....	5, 000	150
Sheepshead	....	....	....	....	1, 902	29	21, 345	402
Spanish mackerel, fresh	....	....	....	....	....	....	11, 000	275
Spots and croakers	....	....	....	....	1, 109	18	2, 200	33
Trout, fresh	....	....	....	....	7, 595	191	158, 000	2, 745
Whiting	....	....	....	....	....	....	1, 300	20
Total	....	....	....	....	122, 094	2, 312	1, 006, 482	22, 862
Gill nets:								
Channel bass	....	....	1, 600	$24	21, 238	319	3, 000	45
Grunts	....	....	....	....	3, 210	49	....	....
Mullet, fresh	143, 000	$1, 430	901, 000	11, 263	595, 414	8, 341	153, 000	1, 430
Mullet, salted	24, 000	360	114, 600	2, 292	76, 416	1, 528	185, 000	4, 320
Mullet roe, salted	2, 000	200	12, 000	1, 200	6, 100	610	8, 500	850
Pompano, fresh	....	....	....	....	630	32	1, 100	33
Sheepshead	3, 100	62	....	....	7, 255	109	13, 225	231
Spanish mackerel, fresh	....	....	....	....	3, 278	163	2, 600	110
Spots and croakers	....	....	....	....	....	....	700	35
Trout, fresh	14, 000	420	....	....	10, 400	257	36, 800	577
Total	186, 100	2, 472	1, 029, 200	14, 779	723, 941	11, 408	403, 925	7, 631
Turtle nets:								
Turtles	....	....	....	....	....	....	2, 144	150
Lines:								
Cat-fish	....	....	....	....	....	....	5, 000	100
Sheepshead	....	....	....	....	....	....	12, 100	217
Total	....	....	....	....	....	....	17, 100	317
Miscellaneous:								
Sponges	....	....	....	....	....	....	2, 500	1, 750
Oysters	....	....	....	....	11, 100	370	262, 500	8, 000
Alligator hides	....	....	....	....	....	240	....	285
Otter skins	....	....	....	....	....	18	....	713
Total	....	....	....	....	11, 100	628	265, 000	10, 748
Grand total	186, 100	2, 472	1, 029, 200	14, 779	857, 135	14, 348	1, 694, 651	41, 708

Apparatus and species.	Calhoun.		Washington.		Santa Rosa.		Escambia.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Angel-fish	....	....	....	....	....	....	14, 486	$181
Blue-fish	....	....	16, 900	$338	8, 725	$175	99, 000	1, 980
Channel bass	....	....	1, 310	20	2, 100	32	3, 333	48
Crevalle	....	....	2, 266	29	1, 100	17	14, 165	138
Flounders	....	....	403	16	325	13	734	34
Lady-fish	....	....	26, 056	261	1, 300	13	22, 655	227
Mullet, fresh	8, 000	$120	115, 000	1, 672	53, 000	707	583, 100	7, 775
Mullet, salted	97, 000	2, 425	414, 000	13, 455	....	....	....	....
Mullet roe, salted	4, 000	400	31, 000	3, 100	....	....	....	....
Pompano, fresh	....	....	12, 700	732	6, 500	390	12, 000	780
Pompano, salted	2, 000	100	13, 800	690	....	....	....	....
Sheepshead	....	....	6, 424	128	7, 145	143	37, 892	721
Spanish mackerel, fresh	....	....	32, 700	981	28, 333	850	30, 000	900
Spanish mackerel, salted	2, 300	104	8, 833	397	....	....	....	....
Spots and croakers	....	....	....	....	1, 300	20	17, 355	337
Sun-fishes	....	....	729	15	....	....	7, 180	223
Trout, fresh	....	....	2, 000	70	2, 100	74	21, 438	750
Trout, salted	12, 000	480	48, 000	1, 920	....	....	....	....
Whiting	....	....	....	....	....	....	7, 689	77
Yellow-tail	....	....	....	....	....	....	7, 160	105
Other fish	....	....	21, 083	216	814	12	57, 350	701
Turtles	....	....	....	....	....	....	720	16
Total	125, 300	3, 629	753, 204	24, 040	112, 742	2, 446	936, 257	14, 993

Table showing by counties and apparatus the yield of the shore fisheries of the west coast of Florida—Continued.

Apparatus and species.	Calhoun.		Washington.		Santa Rosa.		Escambia.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Gill nets:								
Channel bass			500	$8				
Mullet, salted			12,000	390			71,426	$952
Mullet roe, salted			1,300	130				
Spanish mackerel, fresh			750	23			10,102	303
Trout, fresh							8,400	294
Trout, salted			3,105	124				
Total			17,655	675			89,928	1,549
Lines:								
Groupers							18,000	180
Snappers, red							150,000	5,250
Total							168,000	5,430
Miscellaneous:								
Oysters			21,000	910			35,000	1,500
Grand total	125,300	$3,629	791,859	25,625	112,742	$2,446	1,229,185	23,472

SUMMARY.

Apparatus and species.	Lbs.	Value.
Seines:		
Angel-fish	14,486	$181
Blue-fish	148,625	3,163
Channel bass	97,371	1,460
Crevalle	23,546	275
Drum	28,000	425
Flounders	7,962	162
Groupers	13,000	264
Grunts	41,333	1,017
Lady-fish	120,011	2,601
Mullet, fresh	2,423,925	27,844
Mullet, salted	1,921,645	44,555
Mullet roe, salted	111,364	10,080
Pompano, fresh	41,088	2,296
Pompano, salted	15,800	790
Porgies	1,000	20
Pork-fish	500	50
Sailor's choice	2,000	30
"Sardines"	132,000	2,640
Sheepshead	123,756	2,214
Snappers, gray, etc	16,100	469
Spanish mackerel, fresh	115,033	3,495
Spanish mackerel, salted	11,133	501
Spots and croakers	21,964	408
Sun-fishes	7,909	238
Trout, fresh	216,224	4,331
Trout, salted	60,000	2,400
Whiting	8,989	97
Yellow-tail	7,360	112
Other fish	92,047	1,219
Craw-fish	132,000	2,640
Turtles	720	16
Total	5,956,891	115,993
Gill nets:		
Angel-fish	17,100	235
Blue-fish	103,996	2,140
Channel bass	138,997	2,137
Crevalle	14,594	219
Drum	9,855	197
Flounders	24,444	371
Grunts	26,543	516
Mullet, fresh	9,174,590	96,775
Mullet, salted	581,308	11,310
Mullet roe, salted	32,535	3,220
Pompano, fresh	314,548	15,465
Pompano, salted	7,425	446
Sailor's choice	67,202	1,148
Sheepshead	516,377	7,194
Snappers, gray, etc	46,197	778
Spanish mackerel, fresh	255,214	10,748
Spanish mackerel, salted	12,446	692
Spots and croakers	1,809	57
Sturgeon	9,254	331
Trout, fresh	487,606	10,817
Trout, salted	3,105	124
Whiting	600	12
Other fish	1,410	39
Total	11,847,155	164,971

Apparatus and species.	Lbs.	Value.
Cast nets:		
Mullet, fresh	41,100	$553
Mullet, salted	750	15
Mullet roe, salted	100	10
"Sardines"	18,000	450
Total	59,950	1,028
Turtle nets:		
Turtles	131,044	6,412
Lines:		
Amber-fish	18,600	620
Angel-fish	22,000	1,038
Barracuda	31,000	1,240
Blue-fish	8,000	667
Cat-fish	5,000	100
Flounders	155	16
Groupers	145,000	2,530
Grunts	573,000	14,525
Hog-fish	74,750	3,185
King-fish	243,000	3,645
Porgies	91,800	2,295
Pork-fish	9,462	946
Sailor's choice	19,066	1,907
Sheepshead	23,214	385
Snappers, red	282,000	9,235
Snappers, other	37,070	1,610
Spanish mackerel	12,000	400
Yellow-tail	59,133	5,913
Other fish	427,721	22,186
Total	2,081,971	72,443
Miscellaneous:		
Angel-fish	5,600	242
Groupers	12,000	280
Grunts	31,000	775
Hog-fish	6,850	295
Porgies	5,400	135
Pork-fish	2,000	200
Sailor's choice	1,113	113
Snappers, gray, etc	11,264	439
Yellow-tail	5,547	555
Other fish	15,960	873
Sponges	30,755	29,294
Crabs	6,240	208
Craw-fish	25,500	510
Clams	7,084	171
Conchs	500	30
Oysters	778,008	33,114
Terrapin	11,400	1,250
Alligator hides		12,450
Otter skins		14,481
Total	956,221	95,415
Grand total	21,033,232	456,262

NOTES ON CERTAIN FISHERIES.

The sturgeon fishery.—Sturgeon are quite numerous in nearly all rivers on the west coast of Florida north of Cedar Key during their regular season, but very little attention has been given to their capture. In 1896 a fishery was started on the Suwanee River and a few were secured, and it is likely that the fishery will be carried on more extensively hereafter. No caviar was put up during this first season.

The mullet fishery.—So far as the number of persons employed, quantity and value of apparatus used, and quantity of catch are concerned, this is the most important fishery in the State. Mullet have appeared along the shores in such abundance each year that the fishermen have thought the supply inexhaustible until within the last year or two. In 1897 a law was passed forbidding the catching of any fish from June 15 to August 15, and of mullet alone from November 15 to December 31, except with cast nets and hook and line. The existence of this law explains part of the decrease that has taken place, as it went into effect in 1897 and thus shortened the fishing season.

The main cause of the decrease lies further back than this, however. Prior to 1896 a large business in salted mullet was carried on with Cuba, but this trade was practically abandoned in 1896, owing to the high tariff imposed on imported fish as a consequence of the revolution in Cuba. Previous to this time the salt-fish trade with Cuba had been virtually controlled by Americans. Now that conditions in Cuba are more favorable, this trade will probably revive and prove a boon to the Florida fishermen.

There was formerly a great deal of waste in the handling of fresh mullet, owing to the softening of the fish during transportation from the camps to the shipping centers. As the camps are scattered many miles up and down the coast, and sailing vessels are generally used, when head winds are encountered the whole cargo might be lost, as the fish were merely stowed in the hold in bulk with a little cracked ice thrown on them. Nearly all of the transporters are now fitted with refrigerators, in which the fish are stored, and brought to market with very little loss, even though the vessels should be detained.

An important feature of the mullet fishery is the large number of transporters used in it. In 1897 there were employed 27 vessels, with an aggregate tonnage of 255.95, which were valued, with their outfits, at $44,268. These were manned by 58 men.

The following table shows the catch of mullet for six different years:

	1879.	1880.	1889.	1890.	1895.	1897.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Mullet, fresh	1,058,083	....	8,794,586	10,650,959	12,310,953	11,639,615
Mullet, salted	2,504,422	....	2,728,785	2,968,254	5,714,134	2,503,703
Mullet, smoked	....	....	4,500	3,200	....	....
Mullet roe, salted	6,662	....	244,080	298,549	299,061	143,999
Total	3,569,167	2,028,250	11,771,951	13,920,962	18,324,148	14,287,317

The red-snapper fishery.—Pensacola is the center of this fishery, but it is also prosecuted incidentally from Key West, Tampa, St. Petersburg, and Cedar Key. The catch landed at Pensacola is greater than at all other points in the United States combined. While there has been a decrease since 1895 in the number of vessels engaged, the total catch has increased, as well as the average catch per man and per vessel.

Table showing the number of vessels, tonnage, and men employed in the red-snapper fishery.

Year.	No. of vessels.	Tonnage.	No. of men.	Year.	No. of vessels.	Tonnage.	No. of men.
1875	11	328.22	60	1883	24	662.91	133
1876	13	376.95	71	1884	25	577.96	140
1877	11	323.47	57	1885	27	751.56	163
1878	10	297.10	54	1886	33	1,149.10	231
1879	11	282.12	60	1889	35	980.25	218
1880	14	302.11	71	1890	34	973.65	218
1881	21	458.03	108	1895	42	1,209.62	280
1882	26	732.39	150	1897	36	1,060.68	235

Catch of red snappers by vessels and by boats.

	1895.		1897.	
	Lbs.	Value.	Lbs.	Value.
Caught by vessels	4,587,715	$144,855	4,874,687	$157,265
Caught by boats	195,815	6,959	150,000	5,250
Total	4,783,530	151,814	5,024,687	162,515

Comparative summary of the Pensacola red-snapper catch.

Year.	Lbs.	Average catch.	
		Per vessel.	Per man.
1880	1,450,000	103,571	20,423
1884	2,380,800	95,232	17,006
1889	3,554,176	101,548	16,304
1890	4,144,842	121,907	19,013
1895	4,587,715	109,231	16,385
1897 (fiscal year)	4,874,687	135,408	20,743

The principal snapper banks of the Gulf lie between Mobile Bay and Cedar Key. They are fished during the warmer months; the rest of the time the vessels go to the Campeche Banks off the Yucatan coast. There is no apparent diminution in the abundance of the fish on these banks. Groupers are also taken in this fishery, being found on the banks in company with the red snappers; but the fishermen do not seek them especially, as they bring a very low price.

Several New Orleans vessels land their catch at Pensacola when they are fishing in the eastern part of the Gulf, whence it is sent to their home port.

The sponge fishery.—This fishery, which is not operated elsewhere in the United States, is of great importance to Florida. Next to the manufacture of cigars, it is the leading industry of Key West. It is prosecuted from Key West, Tarpon Springs, and Apalachicola. The sponges are landed principally at Key West and Tarpon Springs, although a few were sold last season at St. Marks and Apalachicola. They are purchased at auction by buyers for firms in the Northern States, who prepare them for market at their warehouses in the three places named.

The following table shows the catch for five years by vessels hailing from the above-named ports:

Place.	1880.		1889.		1890.		1895.		1897.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Key West	....	....	307,595	$367,954	358,467	$427,375	280,372	$344,015	270,906	$277,197
Tarpon Springs	....	....	....	....	....	....	16,344	27,168	56,000	23,300
Cedar Key	....	....	952	965	4,160	5,000	2,048	3,707	....	....
St. Marks	....	....	990	990	640	640	....	....	....	....
Apalachicola	....	....	7,022	11,178	3,505	5,667	7,356	11,981	5,950	5,092
Total	207,000	$200,750	316,559	381,087	366,772	438,682	306,120	386,871	332,856	305,589

The fishery has varied considerably during the past eight years, especially as regards the prices realized. While the catch of 1897 was larger than that for 1895, the value for the latter year is $81,282 more, the sponges taken in 1897 being of a poorer quality than in 1895.

In 1895 the sponge fleet consisted of 119 vessels and 200 boats. In 1897 102 vessels and 184 boats were engaged. The decrease is attributable to the poor season of 1896 and to the hurricane of September 29 of that year, which sank a number of vessels and seriously damaged others.

According to the reports of fishermen and others interested in the business, the sponges are decreasing in number, while inferior grades are now being secured. Formerly most of the sponges were taken in 10 feet depth of water, while now some of the sponging operations are conducted in water as deep as 45 feet, which is about the limit at which the fishery can be successfully prosecuted under the methods which now prevail.

Artificial propagation has been urged for some time by the most far-sighted fishermen and dealers, but the lack of suitable laws permitting the ownership of land for this purpose has heretofore prevented. In 1897 such a law was passed, allowing "any person or persons owning lands bordering upon the waters of the State to propagate and grow sponges in the waters in front of such lands to a depth not exceeding 1 fathom at low tide, and they shall have the exclusive right to sponge or propagate and grow sponges within such limits." It is quite certain that good will result from the adoption of this law if the growers are properly protected.

The oyster fishery.—There are extensive natural oyster deposits on the west coast of Florida, the most important of which are in De Soto, Hillsboro, Levy, Franklin, Washington, and Escambia counties. Ever since 1890 the oyster industry has been on the decline. In that year 2,597,567 pounds, valued at $93,692, were secured, while in 1897 only 1,258,008 pounds, valued at $50,258, were taken. Excessive tonging is responsible for a part of the decrease, and much damage is attributed to the severe storms which visit this coast, and to severe frosts when the beds were exposed at low water. The beds suffer little, if any, from the principal enemies of the oyster in other regions—starfishes and borers.

The greatest decrease is in Franklin County, where the catch fell off 785,782 pounds.

In 1890 there were 2 oyster canneries in operation in this section, both in Franklin County; and they were still operating in 1897. Owing to the scarcity of oysters, it is customary for the larger of these canneries to shut down every other year, the output of both being controlled by one firm. Since this investigation was made a cannery has been started in Hillsboro County.

The decrease in the productiveness of the natural beds has led to the institution of oyster-culture, especially in Hillsboro Bay, Manatee River, at Cedar Key, and in Escambia and East bays, but oyster cultivation has not been generally taken up, and public sentiment is not yet sufficiently in favor of it to secure planted beds from poaching.

The turtle fishery.—Among the most valuable of the fishery products of Florida is the turtle, of which there are three species, the green, the loggerhead, and the hawksbill. In 1890 this fishery was prosecuted in 8 counties, while in 1897 it was carried on only in Monroe, Levy, Franklin, and Escambia counties. The total catch in 1897 was 634,616 pounds, valued at $22,736, and of this 546,752 pounds, worth $17,770, were taken in Monroe County. Monroe and Levy counties are the only ones that employ vessels in this fishery.

Turtles are gradually becoming scarce in Florida. Monroe County is the only one that shows an increase over the 1890 figures. In that year 297,157 pounds, valued at $15,866, were taken in this county, while in 1897 the catch was 546,752 pounds, worth $17,770. The greater part of this increase is due to the capture of turtles along the Yucatan coast by vessels trading in that region. These vessels carry turtle nets and use them whenever possible. They also buy turtles from Yucatan people, but these are not shown in the statistical tables.

In a number of counties where turtles were formerly quite common none are taken now. This is largely owing to the fact that turtle eggs have been eagerly sought for. The turtle should be protected during the breeding season, and the eggs should never be taken.

Very little use is made of turtles other than in the fresh state. A Key West firm began the preparation of green turtle soup in 1896 and has been very successful.

An idea of the extent of the turtle industry of Florida in past years can be gained from a glance at the following table:

Counties.	1880.	1889.	1890.	1895.	1897.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Monroe		291, 695	297, 157	410, 142	546, 752
Lee		3, 500	3, 000	4, 375	
De Soto			4, 000		
Manatee		60, 665	60, 665		
Hillsboro		11, 735	12, 004	5, 000	
Levy		70, 705	89, 958	107, 610	85, 000
Franklin				3, 850	2, 144
Washington		100			
Santa Rosa		740	7, 000		
Escambia		740	2, 250		720
Total	180, 000	439, 880	476, 034	530, 977	634, 616

FISHERIES OF ALABAMA.

Alabama has a much shorter coast line than any other State in the Gulf region. The more extensive and valuable section of the coast of the State consists of the shores of Mobile Bay and Mississippi Sound. Mobile Bay extends inland for a distance of about 40 miles, and is the only important indentation. The Mobile River, a large stream formed by the junction of the Alabama and Tombigbee rivers, flows into its headwaters. Mississippi Sound extends along the shore of Alabama west of Mobile Bay, the two bodies of water being connected by Grant Pass.

The two counties of the State which reach the coast and are interested in fisheries are Mobile County on the west and Baldwin County on the east of Mobile Bay. The city of Mobile, located on the west side of the bay in Mobile County, is the principal fishing and trade center. There are several small settlements in both counties which are to some extent fishing localities, the most important being Mon Louis Island, Dauphin Island, Coden, and Bayou Labatre, in Mobile County; Bromley, Daphne, Point Clear, Fish River, Magnolia Springs, Bonsecour, and Shell Banks, in Baldwin County.

The fishing interests of this State are divided into three principal branches, viz, the vessel fisheries, the shore or boat fisheries, and the trade in fishery products. The persons employed on the fishing vessels numbered 150, on boats in the shore fisheries 443, and in packing and fish houses of various kinds 196, a total of 789.

The number of vessels engaged in fishing was 53, having a value, including their outfits, of $50,945; the number of boats employed in the shore fisheries was 254, valued at $12,939; the apparatus used on vessels and boats, consisting of seines, trammel nets, lines, tongs, and spears, was valued at $9,205; the value of the shore and accessory property employed in the fishery trade was $49,350, and the amount of cash capital utilized $42,750; a total investment, including the cash capital, of $165,189.

The products of the fisheries consisted of 2,846,009 pounds of fish, valued at $72,797; 73,200 hard crabs, or 24,400 pounds, valued at $505;

40,600 pounds of shrimp, valued at $609; 1,121 terrapin, or 2,934 pounds, valued at $320; and 255,063 bushels, or about 102,025 barrels, of oysters, the meats of which weighed 1,785,438 pounds and were worth $60,207; a total of 4,699,381 pounds, having a value of $134,438.

The yield of the fisheries of this State in 1897 can not be regarded as fairly representing the annual average, from the fact that the enforcement of a quarantine in the months of September, October, and the early part of November, in consequence of the yellow-fever epidemic which prevailed during that period, seriously interfered with the prosecution of the industry and caused a considerable falling off in the products, especially those of the oyster fisheries.

The three tables which follow show by counties the number of persons employed, the number and value of vessels and boats, the quantity and value of apparatus of capture, the value of shore and accessory property, the amount of cash capital, and the quantity and value of the products of the fisheries of Alabama in 1897.

Table showing by counties the number of persons employed in the fisheries of Alabama in 1897.

How engaged.	Baldwin.	Mobile.	Total.
On vessels fishing	45	105	150
Boat or shore fishermen	170	273	443
Shoresmen		196	196
Total	215	574	789

Table showing by counties the vessels, boats, and apparatus employed in the fisheries of Alabama in 1897.

Items.	Baldwin.		Mobile.		Total.	
	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	19	$14,350	34	$26,025	53	$40,375
Tonnage	165.74		356.44		522.18	
Outfit		2,099		8,471		10,570
Boats	85	5,800	169	7,139	254	12,939
Apparatus—vessel fisheries:						
Seines			3	325	3	325
Trammel nets	4	200	6	300	10	500
Lines		23		108		131
Tongs	45	270	65	390	110	660
Apparatus—shore fisheries:						
Seines	3	175	7	535	10	710
Trammel nets	70	3,500	46	2,260	116	5,760
Lines				80		80
Spears			25	7	25	7
Tongs	40	240	130	792	170	1,032
Shore and accessory property				49,350		49,350
Cash capital				42,750		42,750
Total		26,657		138,532		165,189

Table showing by counties and species the yield of the fisheries of Alabama in 1897.

Species.	Baldwin.		Mobile.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Angel-fish	3, 300	$50	2, 700	$65	6, 000	$115
Black bass	25, 200	1, 764	15, 800	1, 106	41, 000	2, 870
Blue-fish	124, 480	2, 490	80, 020	1, 604	204, 500	4, 094
Cat-fish	109, 200	1, 638	78, 800	1, 234	188, 000	2, 872
Channel bass or red-fish	122, 200	4, 277	90, 800	3, 148	213, 000	7, 425
Crevalle	7, 350	110	4, 650	70	12, 000	180
Croakers	246, 800	3, 703	170, 200	2, 453	417, 000	6, 156
Drum	3, 900	59	2, 100	32	6, 000	91
Flounders	18, 200	637	28, 800	965	47, 000	1, 602
Groupers	9, 000	135	60, 000	900	69, 000	1, 035
Mullet, fresh	297, 400	4, 388	293, 900	4, 099	591, 300	8, 487
Mullet, salted	....	....	6, 000	195	6, 000	195
Perch	3, 000	120	2, 000	80	5, 000	200
Pickerel	2, 500	38	1, 500	23	4, 000	61
Pin-fish	2, 500	38	1, 500	23	4, 000	61
Pompano	37, 500	2, 625	22, 800	1, 587	60, 300	4, 212
Red snapper	35, 000	1, 225	300, 000	10, 500	335, 000	11, 725
Sheepshead	49, 000	1, 715	37, 800	1, 234	86, 800	2, 949
Spanish mackerel	46, 600	2, 330	38, 900	1, 630	85, 500	3, 960
Spots	53, 300	811	33, 700	1, 132	87, 000	1, 943
Sun-fishes	48, 681	1, 539	29, 828	1, 044	79, 509	2, 783
Trout	137, 900	4, 573	158, 200	5, 138	296, 100	9, 711
Whiting	2, 000	70	....	....	2, 000	70
Crabs, hard	....	....	24, 400	505	*a* 24, 400	505
Shrimp	....	....	40, 600	609	40, 600	609
Terrapin	....	....	2, 934	320	*b* 2, 934	320
Oysters	471, 940	23, 690	1, 313, 498	36, 517	*c* 1, 785, 438	60, 207
Total	1, 857, 951	58, 225	2, 841, 430	76, 213	4, 699, 381	134, 438

a 73,200 in number. *b* 1,121 in number. *c* 255,063 bushels.

The vessel and shore fisheries.—The principal fisheries prosecuted in Alabama are the seine and trammel-net fisheries, the red-snapper fishery, and the oyster fishery. In addition to these, cat-fish and crabs are taken with trot lines, and flounders are caught in small quantities with spears.

The oyster fishery is of much greater importance than any other branch, and is engaged in by a large number of vessels and boats. The season begins about the 1st of September and continues until the latter part of April, although oysters are taken to a greater or less extent in nearly every month of the year. Tongs are the only apparatus of capture used. The oysters, as they are sold by the fishermen, are divided into three principal grades. These are the plants, cullens, and reefers. The plants and cullens are obtained chiefly from the planted grounds in Bon Secours Bay, a small indentation of Mobile Bay at the lower end of Baldwin County, and also from the planted grounds in Heron Bay and vicinity, which is in the lower part of Mobile County, on Mississippi Sound. The reefers are from the natural reefs in Mobile Bay and Mississippi Sound. The prices received for the different grades of oysters fluctuate more or less, but average from $1.25 to $1.50 a barrel for plants, $1 a barrel for cullens, and about 60 cents a barrel for reefers. The greater part of the catch is sold to the dealers at Mobile.

It was formerly customary for a number of the vessels to engage in buying the oysters from the tongers and transporting them to Mobile. The profits of this enterprise, never very large, finally became so small that it was practically abandoned, and the vessels and boats now carry their own catch to market. Aside from the grades of oysters above referred to, considerable quantities are obtained from the natural reefs for canning purposes. These are sold at Biloxi, Miss., and also to a cannery which has recently been built at Bayou Labatre, the price received being from 25 to 30 cents a barrel. Oysters are also taken in the spring, after the market season is over, for planting purposes, for which the tongers receive 10 cents a barrel delivered on the planting-grounds. They consist of oysters and shells together. The quantity of oysters taken by vessels was 894,915 pounds, or 51,138 barrels, valued at $40,881; the quantity taken by boats was 890,253 pounds, or 50,887 barrels, valued at $19,326; a total, exclusive of oysters for planting purposes, of 102,025 barrels, having a value of $60,207, or nearly one-half the entire value of the fishery products of the State. The oysters taken by vessels included a much larger proportion of the better grades than those taken by boats; hence their value was proportionately greater.

Seines are used to a limited extent on vessels, but are chiefly operated by small boats. The greater number of these are fish seines, and vary in length from 60 to 100 fathoms each, having a depth in the center of 10 to 15 feet and narrowing at the ends to 5 or 6 feet. They are made of cotton twine and cost, according to their size and quality, from $40 to $100 each. The size of the mesh, stretched, is about 2 inches in the center and 3 inches in the remainder of the net. A few shrimp seines are also used. These are made of lighter twine and are usually a little longer than the fish seines, and cost from $60 to $125 each. The catch taken by vessels in seines consisted of 22,200 pounds of fish, valued at $873, and 20,000 pounds of shrimp, valued at $300; the catch by boats was 117,026 pounds of fish, valued at $2,477, and 20,600 pounds of shrimp, valued at $309; a total of 179,826 pounds of fish and shrimp, having a value of $3,959.

The most important apparatus used in the capture of inshore species, locally termed "beach fish," are the trammel nets. These are used to a considerable extent on both vessels and boats. The nets are made of cotton twine, and are divided in two sections, each section being 40 fathoms long and costing about $25 or $50 for the entire net. The size of the mesh in the outside webs is from 10 to 12 inches, and in the inside web about 2½ inches stretched. The quantity of fish taken in trammel nets by vessels was 221,700 pounds, valued at $4,405, and by boats 2,052,508 pounds, valued at $51,538; a total of 2,274,208 pounds, having a value of $55,943.

The red-snapper fishery, which has heretofore been carried on in an irregular manner in this State, was recently established at Mobile, and may grow to much larger proportions in the course of a few years. It is exclusively a vessel fishery, with hand lines as the apparatus of capture. There were five vessels engaged in it, four of which operated during the entire year. The yield of this fishery was 335,000 pounds of red snappers, valued at $11,725, and 69,000 pounds of groupers, valued at $1,035; a total of 404,000 pounds of fish, having a value of $12,760.

The fisheries with trot lines and spears are carried on with small boats and are not extensive. The quantity of cat-fish taken with trot lines was 12,000 pounds, valued at $240, and of hard crabs, with trot lines rigged especially for that purpose, 24,400 pounds, valued at $505. Flounders are the only species taken with spears, the quantity being 17,000 pounds, valued at $550. There were also 2,509 pounds of terrapin, valued at $274. These were picked up in the marshes without the use of apparatus.

The vessel fisheries slightly predominate in the quantity and value of oysters obtained, but are otherwise of much less importance than the shore fisheries. The products taken by vessels aggregated 1,563,815 pounds, valued at $59,219, and by boats 3,136,566 pounds, valued at $75,219. This includes oysters, which are represented by the weight of the meats on a basis of 17½ pounds to the barrel in the shell.

The following tables exhibit by counties, species, and apparatus the quantity and value of products taken in the vessel and shore fisheries of Alabama in 1897:

Table showing by counties, apparatus, and species the yield of the vessel fisheries of Alabama in 1897.

Apparatus and species.	Baldwin.		Mobile.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:						
Angel-fish			1,200	$42	1,200	$42
Blue-fish			1,500	60	1,500	60
Channel bass or red-fish			3,000	105	3,000	105
Croakers			600	9	600	9
Pompano			1,500	105	1,500	105
Sheepshead			3,000	105	3,000	105
Spanish mackerel			1,500	75	1,500	75
Trout			9,900	372	9,900	372
Shrimp			20,000	300	20,000	300
Total			42,200	1,173	42,200	1,173
Trammel nets:						
Channel bass or red-fish	2,000	$70	13,400	469	15,400	539
Croakers	1,000	15	2,000	30	3,000	45
Flounders			400	16	400	16
Mullet	30,000	374	124,000	1,550	154,000	1,924
Pompano	1,000	70			1,000	70
Sheepshead	2,000	70	500	18	2,500	88
Spanish mackerel	1,500	75			1,500	75
Spots	2,200	44	3,200	64	5,400	108
Trout	2,000	80	36,500	1,460	38,500	1,540
Total	41,700	798	180,000	3,607	221,700	4,405
Lines:						
Grouper	9,000	135	60,000	900	69,000	1,035
Red snapper	35,000	1,225	300,000	10,500	335,000	11,725
Total	44,000	1,360	360,000	11,400	404,000	12,760
Tongs:						
Oysters	331,940	18,890	562,975	21,991	894,915	40,881
Grand total	417,640	21,048	1,145,175	38,171	1,562,815	59,219

Table showing by counties, apparatus, and species the yield of the shore fisheries of Alabama in 1897.

Apparatus and species.	Baldwin.		Mobile.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:						
Angel-fish	500	$8			500	$8
Blue-fish	5, 130	103	3, 500	$44	8, 630	147
Cat-fish	1, 000	15	1, 000	7	2, 000	22
Channel bass or red-fish	4, 950	173	2, 000	40	6, 950	213
Croakers	10, 500	158	20, 000	200	30, 500	358
Drum	500	8			500	8
Flounders	1, 200	42			1, 200	42
Mullet			1, 500	23	1, 500	23
Pompano	1, 500	105	300	12	1, 800	117
Sheepshead	2, 000	70	6, 000	120	8, 000	190
Spanish mackerel	2, 500	125	10, 500	210	13, 000	335
Spots	2, 100	32			2, 100	32
Sun-fishes	2, 221	78			2, 221	78
Trout	5, 700	188	30, 000	600	35, 700	788
Whiting	2, 000	70			2, 000	70
Shrimp			20, 600	309	20, 600	309
Terrapin			425	46	425	46
Total	41, 801	1, 175	95. 825	1, 611	137, 626	2, 786
Trammel nets:						
Angel-fish	2, 800	42	1, 500	23	4, 300	65
Black bass	25, 200	1, 764	15, 800	1, 106	41, 000	2, 870
Blue-fish	119, 350	2, 387	75, 020	1, 500	194, 370	3, 887
Cat-fish	108, 200	1, 623	65, 800	987	174, 000	2, 610
Channel bass or red-fish	115, 250	4, 034	72, 400	2, 534	187, 650	6, 568
Crevalle	7, 350	110	4, 650	70	12, 000	180
Croakers	235, 300	3, 530	147, 600	2, 214	382, 900	5, 744
Drum	3, 400	51	2, 100	32	5, 500	83
Flounders	17, 000	595	11, 400	399	28, 400	994
Mullet, fresh	267, 400	4, 014	168, 400	2, 526	435, 800	6, 540
Mullet, salted			6, 000	195	6, 000	195
Perch	3, 000	120	2, 000	80	5, 000	200
Pickerel	2, 500	38	1, 500	23	4, 000	61
Pin-fish	2, 500	33	1, 500	23	4, 000	61
Pompano	35, 000	2, 450	21, 000	1, 470	56, 000	3, 920
Sheepshead	45, 000	1, 575	28, 300	991	73, 300	2, 566
Spanish mackerel	42, 600	2, 130	26, 900	1, 345	69, 500	3, 475
Spots	49, 000	735	30, 500	1, 068	79, 500	1, 803
Sun-fishes	47, 460	1, 661	29, 828	1, 044	77, 288	2, 705
Trout	130, 200	4, 305	81, 800	2, 706	212, 000	7, 011
Total	1, 258, 510	31, 202	793, 998	20, 336	2, 052, 508	51, 538
Lines:						
Cat-fish			12, 000	240	12, 000	240
Crabs, hard			24, 400	505	24, 400	505
Total			36, 400	745	36, 400	745
Spears:						
Flounders			17, 000	550	17, 000	550
Tongs:						
Oysters	140, 000	4, 800	750, 523	14, 526	890, 523	19, 326
Taken without apparatus:						
Terrapin			2, 509	274	2, 509	274
Grand total	1, 440, 311	37, 177	1, 696, 255	38, 042	3, 136, 566	75, 219

THE WHOLESALE FISHERY TRADE.

The city of Mobile is the principal market and point of distribution for the fishery products of the coastal waters of Alabama. The only other localities where the fishery trade is prosecuted are Coden and Bayou Labatre, located on the shores of Mississippi Sound, in the western part of the State, about 25 miles from Mobile. These places are less favorable as shipping-points on account of being about 9 miles from the railroad.

The most important branches of shore industry connected with the fisheries are the wholesale trades in fresh fish and oysters. Shrimp and crabs are also handled to a limited extent, and in 1897 an oyster cannery began to operate at Bayou Labatre.

The trade in fresh fish, which is the more extensive branch, was carried on chiefly by four firms at Mobile. The fish handled consist of a large variety of local species, or "beach fish," taken in the seines and trammel nets, and also of red snappers and groupers. These two species have usually been obtained at Pensacola, but during the past year about one-half the quantity utilized were landed by Mobile vessels. The fish are packed with ice in boxes and barrels and are shipped to numerous points in Alabama and adjacent States. The quantity handled was 3,151,900 pounds, valued at $127,065.

The oyster trade is engaged in to a greater or less extent by eight firms, two of which are also fresh-fish dealers. The greater part of the oysters are opened and sold by count. They are divided into four grades, designated as plants, cullings, selects, and reefers. The first two grades are obtained from the planted grounds and the last two from the natural reefs. The oysters are packed with ice for shipment in buckets, half barrels, and barrels, and small quantities are also put up in hermetically sealed buckets holding from 1 to 4 quarts. The output of the cannery at Bayou Labatre above referred to consisted chiefly of canned oysters, shrimp and crabs being prepared in limited quantities. In order to avoid exposing the private interests of the firm, this being the only cannery in the State, the products have been included as opened oysters, whole shrimp, and live crabs, with the value received for them after being canned. The aggregate quantity, therefore, of oysters utilized for opening and canning purposes was 26,420,000 in number, or 104,061 gallons, the value of which as sold was $106,164. There were also 1,850 barrels of oysters sold in the shell, valued at $3,646, the total value of the various branches of the oyster trade being $109,810. The quantity of shrimp handled raw and canned, represented in a raw condition, was 70,600 pounds, valued as sold at $3,198, and the number of crabs was 135,600, valued at $2,220.

There were 10 establishments in the State engaged in handling fishery products at wholesale, 8 of which were located at Mobile, 1 at Coden, and 1 at Bayou Labatre. In these 196 persons were employed as shore hands. The value of the shore and accessory property used was $49,350; the amount of cash capital was $42,750; the wages paid amounted to $28,556, and the aggregate value of the products handled was $242,293.

The extent of the wholesale trade in fishery products in Alabama in 1897 is shown in the following table:

Table showing the extent of the wholesale trade in fishery products for Alabama in 1897.

Items.	Quantity.	Value.
Establishments	10	$49, 350
Cash capital	....	42, 750
Wages paid	....	28, 556
Employees	196	....
Products handled.		
Oysters opened...number..	*26, 420, 000	106, 164
Oysters sold in the shell, barrels	1, 850	3, 646
Shrimp ...pounds..	70, 600	3, 198
Crabs ...number..	135, 600	2, 220
Angel-fish ...pounds..	6, 000	120
Black bass...do....	41, 000	3, 620
Blue-fish...do....	201, 000	8, 040
Cat-fish ...do....	175, 000	3, 675
Channel bass ...do....	211, 000	10, 550
Crevalle ...do....	12, 000	270
Croakers...do....	397, 000	13, 910
Drum...pounds..	6, 000	$190
Flounders ...do....	30, 000	1, 750
Groupers ...do....	73, 000	1, 625
Jurel ...do....	3, 000	80
Mullet ...do....	590, 000	12, 050
Pickerel ...do....	4, 000	110
Pin-fish ...do....	4, 000	120
Pompano ...do....	60, 000	7, 250
Red snapper ...do....	710, 000	30, 500
Sheepshead ...do....	80, 800	4, 140
Silver perch ...do....	5, 000	320
Spanish mackerel...do....	105, 000	6, 900
Spots ...do....	87, 000	2, 430
Sun-fishes ...do....	79, 500	4, 335
Trout...do....	269, 600	15, 040
Whiting ...do....	2, 000	40
Total value of products	....	242, 293

* Equals 104,061 gallons.

FISHERIES OF MISSISSIPPI.

Description of the coast.—The coast line of Mississippi is broken by a number of small indentations, the most important of which are Point Aux Chenes Bay, Pascagoula Bay, Biloxi Bay, and Bay St. Louis. Each of these receives the waters of a number of small streams, the largest of which is the Pascagoula River, emptying into Pascagoula Bay; Biloxi River, emptying into Biloxi Bay, and the Wolf River, emptying into Bay St. Louis. At a distance of about 10 miles from the shore is a low broken chain of small sandy islands, none of which has more than an occasional inhabitant. Of these, Ship Island, lying directly off of Biloxi, is the most important and furnishes the only good harbor for large vessels on the coast. Mississippi Sound, extending the entire length of the coast and terminating on the east at the entrance of Mobile Bay, Alabama, lies between the islands and the mainland. Its waters are too shallow for navigation by large vessels, but it is of considerable importance as a fishing-ground.

Fishing localities.—There are three counties on the coast of this State, each of which is interested in the fisheries. These are Jackson, Harrison, and Hancock. The fisheries of Harrison County are much more extensive than in the other two counties combined. Fishing is prosecuted commercially or otherwise in all the localities along the shore, but the principal points are at Scranton and Ocean Springs, in Jackson County, Biloxi, in Harrison County, and Bay St. Louis, in Hancock County. These are all small towns, Biloxi, with a population not exceeding 5,000, being the largest and most important fishing and trade center.

General statistics.—The number of persons employed on the vessels fishing and transporting was 382; on boats in the various branches of shore fisheries, 679; in the canneries and packing houses, 1,504—a total of 2,565.

The number of vessels engaged in fishing and transporting fishery products was 83, having a value, including their outfits, of $107,063; the number of boats of all classes used in the shore fisheries was 439, valued at $17,039. The apparatus of capture used by vessels and boats, consisting of seines, trammel nets, gill nets, cast nets, dredges, tongs, spears, and lines, was valued at $19,255. The value of shore and accessory property, which comprises chiefly the canneries and the packing houses, was $125,644—a total investment, if the cash capital employed in the canning and packing industries, amounting to $249,300, is included, of $518,301.

The products of the fisheries consisted of 1,358,890 pounds of fish, valued at $46,041; 1,903,165 pounds of shrimp, valued at $28,804; 458,520 hard and soft crabs in number, valued at $5,214; 3,372 terrapin, valued at $1,275; and 629,713 bushels, or about 251,885 barrels of oysters, valued at $110,964; the total value of products being $192,298.

In the quantity and value of nearly all products, except shrimp, there was a large falling off from recent years. This may be explained by the fact that owing to the prevalence of yellow fever in this section in the fall of 1897 a rigid quarantine was maintained from September 6 to November 12; all means of transportation were suspended and the fisheries and canning and packing industries were practically discontinued. The shrimp fishery has materially increased, and it seems probable that under more favorable conditions all other branches of the fisheries would have been more extensive than ever before.

The three following tables show, by counties, the number of persons employed, the number and value of vessels, boats, and apparatus used, the amount of capital invested, and the quantity and value of the products of the fisheries of Mississippi in 1897:

Table showing by counties the number of persons employed in the fisheries of Mississippi in 1897.

Counties.	On vessels fishing.	On vessels transporting.	Boat or shore fishermen.	Shoresmen.	Total.
Jackson	20	....	271	143	434
Harrison	241	17	296	1,107	1,661
Hancock	104	....	112	254	470
Total	365	17	679	1,504	2,565

Table showing by counties the vessels, boats, and apparatus employed in the fisheries of Mississippi in 1897.

Items.	Jackson.		Harrison.		Hancock.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	5	$4,100	55	$54,625	18	$13,300	78	$72,025
Tonnage	44.45		540.61		179.49		764.55	
Outfit		1,488		18,855		3,250		23,593
Vessels transporting			5	9,100			5	9,100
Tonnage			90.33				90.33	
Outfit				2,345				2,345
Boats	169	4,953	204	9,850	66	2,236	439	17,039
Apparatus—vessel fisheries:								
Seines	4	475	35	4,300	1	100	40	4,875
Trammel nets	3	180					3	180
Gill nets	1	130					1	130
Dredges			8	275			8	275
Tongs	19	93	251	1,316	78	468	348	1,877
Spears	4	4					4	4
Apparatus—shore fisheries:								
Seines	25	2,025	47	5,975			72	8,000
Trammel nets	18	1,320	9	270	2	90	29	1,680
Cast nets			15	60	60	240	75	300
Lines		113		27		46		186
Spears	10	10					10	10
Tongs	130	654	131	786	48	288	309	1,728
Minor apparatus			20	10			20	10
Shore and accessory property		9,650		95,870		20,124		125,644
Cash capital		7,400		166,900		75,000		249,300
Total		32,595		370,564		115,142		518,301

Table showing by counties and species the yield of the fisheries of Mississippi in 1897.

Species.	Jackson.		Harrison.		Hancock.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black bass	15,000	$750			12,000	$600	27,000	$1,350
Blue-fish	33,300	1,105					33,300	1,105
Buffalo-fish	21,500	215					21,500	215
Cat-fish	28,000	560			3,200	160	31,200	720
Channel bass or red-fish	153,800	6,043	33,200	$1,660	12,000	600	199,000	8,303
Croakers	18,700	324	21,200	1,060	8,500	425	48,400	1,809
Drum, salt-water			3,000	150	2,000	100	5,000	250
Flounders	21,600	672	6,600	330			28,200	1,002
Mullet	187,100	1,891	46,500	850	7,000	140	240,600	2,881
Perch	5,000	150					5,000	150
Pin-fish	20,000	370	18,880	944			38,880	1,314
Pompano	23,000	1,400	1,800	180			24,800	1,580
Sheepshead	79,400	2,566	21,500	1,075	9,250	462	110,150	4,103
Spanish mackerel	45,800	3,180	3,960	396	15,000	1,500	64,760	5,076
Spots	3,500	105					3,500	105
Sun-fishes	23,300	433	1,000	50	500	25	24,800	508
Trout	390,500	12,545	39,300	1,875	23,000	1,150	452,800	15,570
Shrimp	222,400	3,592	1,670,765	25,062	10,000	150	1,903,165	28,804
Crabs, hard	5,280	92	90,360	2,052	36,000	1,350	[1] 131,640	3,494
Crabs, soft	1,200	120	4,000	400	16,000	1,200	[2] 21,200	1,720
Terrapin			6,798	1,275			[3] 6,798	1,275
Oysters	567,441	19,847	3,045,141	77,480	795,410	13,637	[4] 4,407,992	110,964
Total	1,865,821	55,960	5,014,004	114,839	949,860	21,499	7,829,685	192,298

[1] 394,920 in number.
[2] 63,600 in number.
[3] 3,372 in number.
[4] 629,713 in bushels.

The vessel and shore fisheries.—The oyster fishery is of much greater importance than any other fishery in the State. Its development has taken place chiefly since 1880, and has been largely due to the establishment of the oyster canneries, which have greatly increased the demand for the products. This fishery now employs a large fleet of vessels and boats, and is a source of considerable revenue to fishermen and shore employees engaged in preparing the products for market. The season for taking oysters begins October 1 and closes April 30. Until quite recently oyster tongs were the only apparatus of capture used on vessels and boats in this fishery, but in 1897 three small steamboats and one schooner were fitted with dredges. The quantity of oysters taken by vessels with dredges was 51,871 barrels, valued at $15,728, and with tongs, 105,079 barrels, valued at $45,493—a total catch by vessels of 156,949 barrels, having a value of $61,221. The catch by small boats, on which tongs were the only apparatus employed, aggregated 94,935 barrels, valued at $49,743.

The oysters are nearly all obtained from the natural reefs in Mississippi Sound and in the vicinity of the islands along the coast. Oysters have been planted to some extent for many years at Biloxi, Ocean Springs, and Scranton, and there are still considerable areas of bottom utilized for planting purposes in these localities, but the results have never been fully satisfactory.

The shrimp fishery, which was comparatively small until within the last few years, now ranks next in importance to the oyster fishery. The entire catch of shrimp—except 10,000 pounds, valued at $150, obtained with cast nets—was taken in seines by vessels and large sailboats, each having a crew of four men, that being the number required to fish a seine. The fishing season is from about March 15 to May 1, and again in the fall from August 1 to November 1. The length of the seines varies more or less, but is usually about 115 fathoms each, with a depth of 6 feet at the ends and 12 feet in the center. The size of the mesh is 2½ inches stretched. The seines are made of 9 to 12 thread cotton twine, and cost from $100 to $125 each. To facilitate the fishing operations, and for the purpose of securing larger quantities of shrimp, some of the packers employ a number of transporting vessels. These are supplied with ice and sent out on the fishing-grounds to buy the catch of the vessels and boats. The remainder of the shrimp is landed by the fishermen. Many of the fishing craft are owned by the packers, but the usual method in such cases is to have the vessel fished on shares, the owner paying the market price for the shrimp, which is about 1½ cents a pound when landed at the packing houses or sold to the transporting vessels.

The quantity of shrimp taken with seines was almost equally divided between the vessels and boats, the quantity secured by vessels being 951,105 pounds, valued at $14,267, and by boats 942,060 pounds, valued at $14,387.

There is also considerable fishing with seines for fish—chiefly with small boats, vessels being engaged in it to only a limited extent. The season is from March 15 to October 1. The fish seines are made of somewhat heavier twine than the shrimp seines and are more expensive. They are from 95 to 100 fathoms long, the size of mesh being from 2 to 2½ inches stretched, and cost about $150 each. Four or five men are employed in each seine crew. The quantity of fish taken with this apparatus by vessels was 96,100 pounds, valued at $2,980, and by boats 363,740 pounds, valued at $12,918.

In addition to the shrimp and fish taken in seines there was an incidental catch with shrimp seines consisting of 3,473 pounds of terrapin, valued at $650, by vessels, and 3,325 pounds, valued at $625, by boats, the value of all products by seine fishing being $45,817.

The trammel-net fishery is prosecuted during the fall, winter, and spring, and, so far as fish proper are concerned, is of greater importance than the seine fishery, but is of less value when all the products taken by seines are considered. The trammel nets are used in sections of 40 to 50 fathoms each in length, two sections comprising one net. The size of mesh in the inside web is about 2 inches, and in the webs on either side about 14 inches stretched. The cost of the nets when new is from $25 to $30 for each section. The quantity of fish taken by vessels in trammel nets was 186,700 pounds, valued at $6,758, and by boats 376,100 pounds, valued at $11,901.

Considerable quantities of fish are taken with pole and line, and with hand lines, by small boats during the fall. The most important species caught in this manner are the trout and Spanish mackerel. Hard and soft crabs are also caught with trot lines from September 1 to May 15. The trot lines are from 400 to 700 feet long, the bait being attached to snoods placed about 4 feet apart. They cost from $1.25 to $2 each. The line catch aggregated 429,390 pounds of crabs and fish, having a value of $13,851.

Gill nets are used to a very limited extent in the vessel fisheries, the catch amounting to only 5,600 pounds, valued at $455.

Spears were used by one vessel and a number of small boats in the capture of flounders.

Cast nets and dip nets are used in the boat fisheries, the former for taking mullet and shrimp, and the latter for taking soft crabs, the value of the catch of both forms of apparatus being $2,240.

The fisheries prosecuted by vessels are much less extensive than those carried on with small boats, but are gradually assuming greater relative importance, and the forms of apparatus used are becoming more varied. The total value of the products taken by vessels was $86,493, and by boats $105,805.

The following tables exhibit the products of the vessel and shore fisheries in 1897, by counties, apparatus, and species:

Table showing by counties, apparatus, and species the yield of the vessel fisheries of Mississippi in 1897.

Apparatus and species.	Jackson.		Harrison.		Hancock.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Blue-fish	12,000	$360	....	....	....	....	12,000	$360
Channel bass or red-fish	20,000	600	....	....	1,000	$50	21,000	650
Croakers	1,800	27	....	....	6,000	300	7,800	327
Mullet	9,000	90	....	....	1,000	20	10,000	110
Sheepshead	12,000	360	....	....	2,000	100	14,000	460
Spanish mackerel	5,000	300	....	....	....	....	5,000	300
Sun-fishes	6,300	73	....	....	....	....	6,300	73
Trout	15,000	450	....	....	5,000	250	20,000	700
Shrimp	70,000	1,050	881,105	$13,217	....	....	951,105	14,267
Terrapin	....	....	3,473	650	....	....	3,473	650
Total	151,100	3,310	884,578	13,867	15,000	720	1,050,678	17,897
Trammel nets:								
Blue-fish	10,000	380	....	....	....	....	10,000	380
Channel bass or red-fish	56,000	2,480	....	....	....	....	56,000	2,480
Croakers	6,200	128	....	....	....	....	6,200	128
Flounders	1,000	50	....	....	....	....	1,000	50
Mullet	28,000	300	....	....	....	....	28,000	300
Pompano	2,000	140	....	....	....	....	2,000	140
Sheepshead	23,000	790	....	....	....	....	23,000	790
Spanish mackerel	2,500	250	....	....	....	....	2,500	250
Spots	3,500	105	....	....	....	....	3,500	105
Sun-fishes	7,000	110	....	....	....	....	7,000	110
Trout	47,500	2,025	....	....	....	....	47,500	2,025
Total	186,700	6,758	....	....	....	....	186,700	6,758
Gill nets:								
Blue-fish	500	25	....	....	....	....	500	25
Sheepshead	100	5	....	....	....	....	100	5
Spanish mackerel	3,500	350	....	....	....	....	3,500	350
Trout	1,500	75	....	....	....	....	1,500	75
Total	5,600	455	....	....	....	....	5,600	455
Spears:								
Flounders	5,400	162	....	....	....	....	5,400	162
Tongs:								
Oysters	117,250	3,000	1,199,223	33,536	522,410	8,957	1,838,883	45,493
Dredges:								
Oysters	....	....	907,743	15,728	....	....	907,743	15,728
Grand total	466,050	13,685	2,991,544	63,131	537,410	9,677	3,995,004	86,493

Table showing by counties, apparatus, and species the yield of the shore fisheries of Mississippi in 1897.

Apparatus and species.	Jackson.		Harrison.		Hancock.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Blue-fish	6,000	$180	....	....	....	....	6,000	$180
Buffalo-fish	21,500	215	....	....	....	....	21,500	215
Cat-fish	3,500	70	....	....	....	....	3,500	70
Channel bass	41,800	1,463	25,200	$1,260	....	....	67,000	2,723
Croakers	6,000	90	16,200	810	....	....	22,200	900
Flounders	6,000	180	3,600	180	....	....	9,600	360
Mullet	52,500	525	....	....	....	....	52,500	525
Pin-fish	11,000	200	11,880	594	....	....	22,880	794
Pompano	14,000	840	1,800	180	....	....	15,800	1,020
Sheepshead	14,500	435	18,000	900	....	....	32,500	1,335
Spanish mackerel	22,500	1,350	3,960	396	....	....	26,460	1,746
Sun-fishes	3,000	60	....	....	....	....	3,000	60
Trout	52,000	1,540	28,800	1,440	....	....	80,800	2,980
Shrimp	152,400	2,542	789,660	11,845	....	....	942,060	14,387
Terrapin	....	....	3,325	625	....	....	3,325	625
Total	406,700	9,690	902,425	18,230	....	....	1,309,125	27,920

Table showing by counties, apparatus, and species the yield of the shore fisheries of Mississippi in 1897—Continued.

Apparatus and species.	Jackson.		Harrison.		Hancock.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Trammel nets:								
Black bass	15,000	$750			12,000	$600	27,000	$1,350
Blue-fish	4,800	160					4,800	160
Cat-fish	4,500	90			200	10	4,700	100
Channel bass	36,000	1,500	8,000	$400	8,000	400	52,000	2,300
Croakers	4,700	79	5,000	250	1,500	75	11,200	404
Drum, salt-water			3,000	150	500	25	3,500	175
Flounders	4,200	130	3,000	150			7,200	280
Mullet	97,600	976	30,000	600			127,600	1,576
Perch	5,000	150					5,000	150
Pin-fish	9,000	170	7,000	350			16,000	520
Pompano	7,000	420					7,000	420
Sheepshead	29,800	976	3,500	175	5,000	250	38,300	1,401
Spanish mackerel	12,300	930					12,300	930
Sun-fishes	7,000	190	1,000	50	500	25	8,500	265
Trout	40,500	1,435	10,500	435			51,000	1,870
Total	277,400	7,956	71,000	2,560	27,700	1,385	376,100	11,901
Cast nets:								
Mullet			16,500	250	6,000	120	22,500	370
Shrimp					10,000	150	10,000	150
Total			16,500	250	16,000	270	32,500	520
Lines:								
Cat-fish	20,000	400			3,000	150	23,000	550
Channel bass					3,000	150	3,000	150
Croakers					1,000	50	1,000	50
Drum, salt-water					1,500	75	1,500	75
Sheepshead					2,250	112	2,250	112
Spanish mackerel					15,000	1,500	15,000	1,500
Trout	234,000	7,020			18,000	900	252,000	7,920
Crabs, hard	5,280	92	90,360	2,052	36,000	1,350	131,640	3,494
Total	259,280	7,512	90,360	2,052	79,750	4,287	429,390	13,851
Spears:								
Flounders	5,000	150					5,000	150
Tongs:								
Oysters	450,191	16,847	938,175	28,216	273,000	4,680	1,661,366	49,743
Minor apparatus:								
Crabs, soft	1,200	120	4,000	400	16,000	1,200	21,200	1,720
Grand total	1,399,771	42,275	2,022,460	51,708	412,450	11,822	3,834,681	105,805

THE WHOLESALE FISHERY TRADE.

The principal shore industries connected with the fisheries of Mississippi are the canning of oysters, shrimp, and crabs, and the trade in opened oysters, whole shrimp, live crabs, terrapin, and fresh fish.

The oyster-canning business was established at Biloxi in 1881. In that year one cannery was built and put in operation and others were added a few years later. Since that time the industry has grown to considerable proportions and has contributed materially to the prosperity of the communities in which it is carried on. In 1897 there were 4 canneries in operation—3 at Biloxi and 1 at Bay St. Louis. The aggregate value of these, including land, buildings, wharves, machinery, and fixtures, was $88,000, the amount of cash capital utilized was $203,000, and of wages paid $55,552. The number of persons employed was 942. The total value of the output was $346,751. Of this amount $256,664 represents the value of the canned-oyster pack; the remainder, $90,087, is the value of the opened oysters, canned shrimp, and other fish products handled at the canneries.

The packing of shrimp at the canneries and oyster houses has greatly increased during the past few years and is now an important feature of the fishery trade. The shrimp are packed in tin cans, chiefly of the 1 and 2 pound sizes, and also in packages holding 5, 10, and 20 pounds, or 1, 2, and 4 gallons. The quantity of shrimp utilized for packing was 9,304 barrels, costing, as landed from the vessels and boats, $29,286, and having a value when packed of $119,282. Besides this, 572 barrels were sold in a raw or whole condition, at a value of $2,842, the aggregate value of the shrimp trade being $122,124.

Hard crabs have also been prepared at the canneries in various years since about 1882, but the industry has never been extensive, chiefly on account of the limited demand for the goods. The meat of the crabs, after being removed from the shell, is packed in 1 and 2 pound cans, hermetically sealed, and processed in a manner similar to other canned products. The pack consisted of 10,560 1-pound and 2,160 2-pound cans, having a value of $2,035.

The canning industry is of great importance to the fishery interests of this section, not only on account of the increased amount of capital invested, the labor employed, and wages distributed, but it has been largely instrumental in developing the oyster and shrimp fisheries by affording a convenient and ready market for their products. It is not probable that these fisheries would have ever reached their present stage of development under the conditions prevailing before the establishment of the canneries, when New Orleans was the principal market for the catch.

Next in importance to the canning industry is the trade in opened oysters. There were 16 packing houses, exclusive of the oyster canneries, engaged in this branch of business. Of these, 7 were located at Biloxi, 4 at Ocean Springs, and 5 at Scranton. The number of persons employed was 562, the value of shore property used was $35,950, the amount of cash capital $46,300, and of wages paid $32,096. These firms, as already indicated, were also engaged in packing shrimp, and some of them in handling other fishery products.

The oysters are divided into three principal grades, designated as plants, selects, and reefers. After being opened they are counted and packed with ice in wooden buckets for shipment, the covers of the buckets being fastened on with wire nails. The capacity of the buckets ranges from 3 to about 8 gallons, or from 500 to 1,000 oysters, the size of the bucket required depending upon the number and grade of oysters to be packed. They cost from 15 to 28 cents, or an average of about 25 cents each. The oysters are sold by count instead of gallon in nearly all instances. This is an old custom among the oyster-packers of this region, and is said to be due to the fact that the trade which they supply demands solid measure, which renders it difficult, if the oysters are sold by the gallon, to compete with the trade at Baltimore, Md. However this may be, the oysters are shipped without any water except what accumulates from the ice used to keep them cool. The price received by the 1,000 fluctuates considerably, but is approximately from $6.25 to $6.50 for plants, $3.25 to $3.50 for selects, and about $2 for reefers. The number of gallons to 1,000 oysters is generally estimated to be about 7½ for plants, 4½ for selects, and 3 for reefers. The quantity of opened oysters sold in 1897, expressed in number, was 31,615,950, or about 154,711 gallons, having a value of $119,941. The greater part of these was the product of the packing-houses, the quantity prepared at the oyster canneries being only 2,755,000, or about 13,947 gallons, valued at $11,420. It should perhaps be noted that the trade in opened oysters, as shown by the above figures, is little more than half as large as it has been in previous years, but the decline is probably only temporary.

A small number of terrapin are handled by dealers at Biloxi. These are derived from the fisheries of Mississippi and Louisiana, a part of them being shipped from New Orleans. The value of the terrapin trade amounted to $2,805. A few years since a terrapin pen was constructed at Biloxi which is used principally for keeping the animals and improving their condition. It is built on the shore at the water's edge, and is 500 feet square. A part of its area is covered with water having an extreme depth of about 6 feet.

The trade in fresh fish is carried on chiefly by four of the firms located at Scranton. It has not so far become very extensive, apparently on account of not being sufficiently well established to enable the dealers to buy all the fish that may be brought to them, and consequently it sometimes happens that when fish are needed the fishermen, who follow the business in a somewhat irregular manner, are not prepared to supply the demand. The quantity of fish handled aggregated 382,200 pounds, valued at $19,324. In nearly all the localities along the coast considerable quantities are handled at retail. At Biloxi there are also from 700 to 1,000 barrels shipped annually by rail to New Orleans and other points by the fishermen. There are no fish salted in this section except a small quantity of mullet.

There is a very small trade in hard and soft crabs at Biloxi, Ocean Springs, and Scranton. The crabs are packed with ice in baskets, boxes, and tubs and shipped to Mobile and other points. The number of crabs shipped was 70,800, the value of which was $733. In addition to this, a much larger quantity was shipped by individual fishermen.

The number of establishments in the State which handled fishery products at wholesale was 20; the value of shore property, $123,950; the amount of cash capital used, $249,300; of wages paid, $87,648. The number of persons employed in canneries and packing houses, exclusive of fishermen, was 1,504. The aggregate value of the products prepared was $525,186

The extent of the trade in 1897 is shown in detail in the following table:

Table showing the extent of the canning and wholesale trade of fishery products for Mississippi in 1897.

Items.	Biloxi and Bay St. Louis.		Ocean Springs.		Scranton.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Establishments	*11	$114,500	4	$2,300	5	$7,150	20	$123,950
Cash capital	....	241,900	....	2,000	....	5,400	....	249,300
Wages paid	....	74,421	....	2,955	....	10,272	....	87,648
Persons engaged	[1]1,361	....	40	......	103	......	1,504	....
Products received:								
Oysters........barrels	229,060	104,010	8,750	5,850	18,300	13,845	256,110	123,705
Shrimp........do	9,304	29,286	60	180	512	1,798	9,876	31,264
Crabs........number	174,000	888	4,800	40	12,000	70	190,800	998
Terrapin........do	5,113	1,977	....	......	....	......	5,113	1,977
Fish........pounds	16,500	250	....	......	382,200	13,380	398,700	13,630
Products as sold:								
Oysters—								
Opened, plants ...number	4,950,000	30,960	690,000	4,440	1,240,050	8,710	[2]6,880,050	44,110
Opened, selects ......do	13,735,000	45,955	2,810,000	9,373	4,837,500	14,128	[3]21,382,500	69,456
Opened, reefers ......do	320,000	640	....	......	3,033,400	5,735	[4]3,353,400	6,375
Canned, 1-lb. cans ....do	3,368,684	151,047	....	......	....	......	3,368,684	151,047
Canned, 2-lb. cans ....do	1,333,990	105,617	....	......	....	......	1,333,990	105,617
Shells ....barrels	96,000	960	....	......	....	......	96,000	960
Shrimp—								
Whole ....do	....	....	60	270	512	2,572	572	2,842
Headless ....gallons	11,250	4,563	....	......	....	......	11,250	4,563
Pickled ....do	44,775	17,745	....	......	....	......	44,775	17,745
Peeled ....do	825	660	....	......	....	......	825	660
Canned, 1-lb. cans, dry..No	440,304	37,861	....	......	....	......	440,304	37,861
Canned, 1½-lb. cans, dry.No	221,600	30,033	....	......	....	......	221,600	30,033
Canned, 2-lb. cans, dry..No	154,800	16,830	....	......	....	......	154,800	16,830
Canned, 1-pound cans, pickled........No	61,200	4,590	....	......	....	......	61,200	4,590
Canned, 1-lb. cans, salad, number........	96,000	7,000	....	......	....	......	96,000	7,000
Crabs—								
Whole ....number	54,000	563	4,800	50	12,000	120	70,800	733
Canned, 1-lb. cans ....do	10,560	1,540	....	......	....	......	10,560	1,540
Canned, 2-lb. cans ....do	2,160	495	....	......	....	......	2,160	495
Terrapin ....do	5,113	2,805	....	......	....	......	5,113	2,805
Fish—								
Black bass ....pounds	....	....	....	......	5,000	375	5,000	375
Blue-fish ....do	....	....	....	......	15,300	765	15,300	765
Buffalo-fish ....do	....	....	....	......	10,000	300	10,000	300
Cat-fish ....do	....	....	....	......	15,000	725	15,000	725
Channel bass ....do	....	....	....	......	84,000	4,300	84,000	4,300
Croakers ....do	....	....	....	......	7,200	250	7,200	250
Drum ....do	....	....	....	......	1,200	56	1,200	56
Flounders ....do	....	....	....	......	9,200	465	9,200	465
Mullet ....do	....	....	....	......	32,500	930	32,500	930
Perch ....do	....	....	....	......	5,000	250	5,000	250
Pin-fish ....do	....	....	....	......	11,700	351	11,700	351
Pompano ....do	....	....	....	......	4,500	390	4,500	390
Sheepshead ....do	....	....	....	......	35,100	1,821	35,100	1,821
Spanish mackerel ....do	....	....	....	......	28,800	2,400	28,800	2,400
Sun-fishes ....do	....	....	....	......	9,700	481	9,700	481
Trout ....do	....	....	....	......	108,000	5,465	108,000	5,465
Mullet, salted, ¼-barrels.No	150	375	....	......	....	......	150	375
Mullet, salted, ½-barrels.No	50	225	....	......	....	......	50	225
Value of products sold	....	460,464	....	14,133	....	50,589	....	525,186

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*One establishment at Bay St. Louis.

[1] In addition to this number 60 shore or boat fishermen were employed as shoresmen part of the season.

[2] Equals 51,500 gallons.

[3] Equals 93,151 gallons.

[4] Equals 10,060 gallons.

FISHERIES OF LOUISIANA.

The extent of the fisheries of Louisiana in 1897, as shown by the statistics collected, does not properly represent the present condition of the fisheries of that State, owing to quarantine regulations restricting the prosecution of the fisheries during two months in the fall when shipments of all products are generally quite heavy. Notwithstanding this fact the yield in 1897 surpasses any previous year for which we have any record, the value being $713,587, against $681,284 in 1890 and $392,610 in 1880. Had the trade not been restricted by quarantine the value of the product in 1897 would doubtless have approached $900,000.

There are three principal fisheries of Louisiana, viz, the oyster fishery, valued in 1897 at $432,668, which is centered about New Orleans, Houma, and Morgan City; the seine fishery for shrimp and for trout, red-fish or channel bass, sheepshead, etc., the yield of which in 1897 was sold by fishermen for $173,454; and the trot-line fishery for cat-fish, yielding a product valued at $46,682. The remaining $60,783 worth of products consisted of alligator hides, $22,096; crabs, $12,891; terrapin, $4,032; craw-fish, $3,113, and a miscellaneous lot of fish caught by a variety of minor apparatus, such as fyke nets, lines, dip nets, etc.

The oyster industry of Louisiana is the most valuable on the United States coast south of Virginia, the yield in 1897 amounting to 959,190 bushels, worth $432,668 at first hands. Were it not for the quarantine in the fall of 1897 the Louisiana oyster product during that year would doubtless have been 15 to 20 per cent greater.

The oyster reefs extend almost continuously along the southern coast, from the border of the State of Mississippi to the mouth of the Atchafalaya River, and are most abundant in Plaquemines, Terrebonne, Lafourche, St. Bernard, and Jefferson parishes. West of the Atchafalaya River there are a few oyster reefs in Cote Blanche Bay, Marsh Island Pass, and Cameron Pass, but they are only slightly developed and may be entirely omitted in a consideration of the present oyster industry of the State. In general the Louisiana oysters compare favorably with any on the Gulf coast.

There are three centers in the oyster trade of Louisiana, viz, New Orleans, Houma, and Morgan City. The New Orleans trade amounts to about 200,000 barrels annually, of which about 75,000 barrels are received at the Old Basin from Mississippi Sound and the Louisiana marshes east of the Mississippi River; 100,000 barrels at the French Market lugger landing from Bayou Cook, Barataria Bay, Jacks Camp, etc., and the remainder by steamer and rail from the waters of Plaquemines and Jefferson parishes. Nearly all are consumed locally, very few oysters being shipped to outside points.

The oyster reefs on the east side of the Mississippi River, known as the Louisiana Marsh reefs, are utilized by fishermen from Mississippi as well as Louisiana. These reefs are frequently injured by fresh water from the rivers, and the oysters are not usually so valuable as those from the west side of the Mississippi River. In 1897 there were from Louisiana 34 sailboats, worth $14,640, with 123 men, engaged in taking oysters from these reefs for the New Orleans market, and their catch, amounting to 55,860 barrels, was landed at Old Basin and sold for $40,027. These men live mainly in New Orleans, and the oysters are carried from the reefs directly to the New Orleans market.

In Plaquemines Parish, on the east side of the Mississippi River, there is an extensive oyster-planting industry. The locality in which this is carried on is known generally as Salt Works, and includes Yankee Bayou, Scobels Bay, Bokeskie Bayou, Quarantine Bay, Whale Bay, etc. In that vicinity there are 65 camps with 186 oystermen, using 102 sailboats, worth $22,780. They obtain oysters from Louisiana marshes and from the reefs west of the Mississippi River, and bed them on grounds preempted in accordance with the State law. After remaining 6 or 8 months or longer these oysters are taken up and sold in New Orleans. In 1897 the sales from the Salt Works amounted to 34,152 barrels, for which the oystermen received $52,980. Most of these oysters are delivered at the French Market lugger landing in New Orleans.

The finest oysters in Louisiana are from the Bayou Cook section, under that name being included nearly all the waters of the western half of Plaquemines Parish, and especially Bayou Chute, Grand Bayou, Bay Adam, Bayou Fontenal, Bayou des Huitres, and the adjacent bayous. These oysters are the result of the most careful system of individual ostreiculture along the Gulf coast. The natural reefs in the Bayou Cook section were exhausted about thirty years ago, and the colony of Austrians settled there have since depended on gathering oysters in Lake Barre, Timbalier Bay, and other waters of southern Louisiana during the spring and planting them in Bayou Cook and the adjacent waters, where they remain until the following season, acquiring in the meantime the peculiar flavor which distinguishes the oysters from that locality. The oystermen of Bayou Cook are among the most enterprising and painstaking of the fishermen on the Gulf coast, and there is no class along that coast better equipped for their work or more successful in its prosecution. They live in small camps adjacent to their bedding-grounds, these camps being constructed of boards or palmettoes raised 10 or 15 feet above the marsh. In 1897 there were 302 persons engaged in the Bayou Cook oyster industry, living in 86 camps, and using 122 sailboats worth $33,675, and 244 rowboats worth $10 or $12 each. The oysters marketed during that season amounted to 62,184 barrels, for which $110,627 was received.

The waters of Jefferson Parish produced large quantities of oysters prior to 1893, but the severe storm in September of that year destroyed most of the reefs as well as the greater portion of the boats and apparatus for carrying on the fisheries. The oysters being situated in shoal water were washed in windrows and covered up by sand. These reefs are gradually recovering from the effect of that storm, but most of the present oystermen of Jefferson Parish work on the reefs in Lafourche and Terrebonne parishes.

Between the Lafourche and the Atchafalaya rivers in the southern part of Lafourche and Terrebonne parishes are located the principal oyster reefs of Louisiana, and from them are drawn the supplies for Houma and Morgan City and much of those for New Orleans, as well as the oysters for bedding at Bayou Cook. These reefs are situated in Lake Barre, Timbalier Bay.

The market for these oysters prior to 1880 was New Orleans, together with a small consumption in the villages and settlements near the reefs; but in 1880 the wholesale trade was started at Morgan City and ten years later several shucking houses were established at Houma for shipping oysters to distant points. The trade has fluctuated considerably from year to year, but has gradually increased. Although the trade in 1897 was much less than usual, on account of the quarantine regulations, yet this section of Louisiana furnished 230,380 barrels of oysters, for which the fishermen received $228,164. Of this quantity 84,468 barrels were marketed at Houma, 95,834 barrels at Morgan City, and 50,078 barrels were consumed in New Orleans and in the settlements adjacent to the reefs. In addition thereto there were about 100,000 barrels of oysters taken for bedding in Terrebonne, Lafourche, Jefferson, and Plaquemines parishes, which are not included in the tables. The number of persons engaged in tonging and transporting these oysters to market was 1,012, using 646 sailboats, worth $85,716, and a large number of skiffs, worth from $8 to $20 each. A number of areas have been preempted in Terrebonne and Lafourche parishes, and some attention has been given during the last year or two to oyster-culture in this section, but the yield from private grounds was inconsiderable in 1897. It is customary for the oystermen to bed the oysters taken at the beginning of the season and before the market houses have opened, but these oysters are usually taken up when the market demand is good.

As used in this connection, a barrel signifies a flour barrel with capacity for 2½ bushels of oysters, and not the local measurement. At no place on the Louisiana coast is a standard measure used in handling oysters. At the French Market in New Orleans a basket of uniform size is used, and in filling it the oysters are heaped up to a point as long as any will remain on and the contents of two of these baskets is considered a barrel, although it is equivalent to only about 85 per cent of a standard barrel. At the Old Basin until quite recently a shallow box was used, this being filled up to a point as in case of the baskets at the French Market and the contents of four of these boxes is considered a barrel, although it is equivalent to only 90 per cent of a barrel. At Morgan City and Houma measurements are made with baskets of uniform size, three of which are supposed to make a barrelful; but at the reefs these are usually heaped, whereas at the markets they are filled even with the rim, and the gain in number of barrels is considerable, amounting usually to 50 per cent of the reef measurement.

Compared with 1890 there has been a very large decrease in the seine fishery of Louisiana, the number of seines used decreasing from 168 worth $14,600 in 1890 to 136 worth $12,211 in 1897, the catch for the former year being 10,576,833 pounds valued at $243,528 and for the latter year 6,554,749 pounds, for which the fishermen received $173,454. The decrease is most noticeable in the yield of shrimp, buffalo-fish and cat-fish, the shrimp falling off from 6,662,050 pounds worth $90,519 in 1890 to 4,402,626 pounds for which the fishermen received $78,792; the buffalo-fish seine catch decreased from 1,030,250 to 147,200 pounds and the cat-fish yield from 653,925 to 144,900 pounds. The large decrease in the yield of the last two species was due mainly to an interdiction of seine fishing in the lakes; but the general decrease in the seine fishery is due largely to the results of the severe storm in September of 1893, which drowned many seine fishermen and destroyed much of the property of the survivors.

With the exception of the Manila fishermen employed by the Chinese shrimp-driers in the Barataria region, and of several seine crews at Morgan City, practically all the seine fishery of Louisiana is tributary to New Orleans, and there are three branches of the fishery tributary to that city, viz, Lake Pontchartrain, the St. Bernard or Shell Beach, and the Barataria Bay seine fishery. In 1897 the first comprised 16 sail boats with an equal number of seines and 94 men, who made their headquarters at Bayou Bridge, and who landed 829,759 pounds of fish, consisting principally of red-fish, trout, sheepshead, and croakers, valued at $38,384, and also of 51 crews of 106 men using 51 seines worth $1,401, which were operated from various points along the shore of Lake Pontchartrain, catching 368,360 pounds of fish worth $16,490.

The St. Bernard seine fishery gave employment in 1897 to 85 men using 17 seines worth $1,870, which yielded 325,060 pounds of fish worth $14,334, made up principally of trout, sheepshead, redfish or channel bass, shrimp, and croakers. Each of the St. Bernard seining crews usually operates from a sail vessel, but the catch is generally sent to market by the Shell Beach Railroad or by wagons.

The Barataria seine fishery gave employment in 1897 to 412 men, using 79 boats worth $23,840, and 40 seines, 6,270 fathoms in length, and valued at $6,765. Their catch consisted of 4,286,626 pounds of shrimp, for which they received $76,223, and 494,965 pounds of other species, consisting principally of trout, red-fish, channel bass, mullet, and croakers, the whole being worth $21,107. Included with the aforegoing are 15 crews of 196 Manilamen, Spaniards, etc., who work principally for the Chinese shrimp-driers near the head of Barataria Bay. Of the shrimp, 1,331,736 pounds were purchased by the Chinese driers, 1,142,360 by New Orleans shrimp-canners, and the remaining 1,781,530 pounds were sold at the French Market in New Orleans. Shrimp are caught throughout the year in Louisiana, but the principal season is during March and April, and through August and September.

The seine fishery prosecuted from Morgan City is of recent origin, beginning in 1896, and was of small extent in 1897, only 4 seines being used, the principal species obtained being shrimp, red-fish or channel bass, trout, etc. The prospects for developing an important seine fishery tributary to Morgan City are extremely favorable.

Although the value of the alligator yield increased slightly from 1890 to 1897, being $21,150 in the former year and $22,096 in the latter, the condition of that industry is far from satisfactory. For many years there has been a steady decrease in abundance of alligators, and the average size of the hides secured has diminished. Localities in which they formerly abounded are now almost exhausted, and it is only by greatly increased efforts that the product has been kept up to its present extent. The number of hides reported in 1889 was 74,240, worth $38,185 at first hands; in 1890, 38,588, worth $21,150, and in 1897, 41,092, for which the hunters received $22,096. The yield of alligators in those parts of the State not covered by the present canvass is estimated at 30,000, valued at $15,000. These alligators are secured principally by shooting, but also in various other ways, such as gaffing with a long pole when hibernating in old stump holes and the like, hooking on lines attached to bent saplings so fastened as to fly up when the alligator becomes fixed to the hook, etc.

The cat-fish fishery in Louisiana, which is the most extensive in the United States, is centered at Morgan City and Melville. The business in 1897 was seriously restricted by quarantine regulations, which prevented shipments during two months of the fall; but the catch by lines amounted to 1,950,064 pounds, for which the fishermen received $46,682. The greater part of these, 979,093 pounds, worth $24,516, were received at Morgan City, where they were dressed and shipped throughout the West. The receipts of cat-fish at Melville aggregated 456,291 pounds gross weight, worth $10,496; and 121,670 pounds of cat-fish, worth $2,836, were received at Plaquemine. The two last-named ports also received 148,273 pounds of buffalo-fish and 18,120 pounds of cat-fish and drum, which were caught in fyke nets. These fisheries were carried on by 828 woodsmen living in the St. Mary, Assumption, Iberia, Iberville, St. Landry, St. Martin, Pointe Coupee, and Avoyelles parishes, and who engaged in fishing, alligator hunting, gathering moss, and the like. In taking cat-fish they use both trot lines and single lines, the latter being employed during high water, the lines being tied to tree trunks and bushes in the swamps, whereas the trot lines are strung out in the lakes and bayous.

The aggregate weight of crabs taken in Louisiana is considerable, amounting in 1897 to 4,376,500 in number, equivalent to about 1,458,833 pounds. These are caught by long lines in brackish waters adjacent to New Orleans, and especially in Jefferson, Orleans, and St. Bernard parishes. Owing to the expense attendant upon marketing the crabs the fishermen obtain very small returns, sometimes receiving only 5 cents for a basket containing 5 dozen crabs, and the total receipts from this source in 1897 were only $12,891.

Some little attention is given to soft crabs in the vicinity of New Orleans, but this is confined principally to searching for them in the shoal water. On account of the high price at which they sell during the winter and early spring it seems probable that a profitable business could be built up in obtaining soft crabs after the manner practiced in Maryland and North Carolina.

The minor fisheries of Louisiana are of very little consequence and scarcely rank as industries. In the various localities a few hand lines, dip nets, crawfish pots, and the like are used at odd times and the surplus above home wants is sold in the vicinity. The total extent of these fisheries as well as of those mentioned before is presented in the following series of tables, showing the number of persons engaged, the boats, apparatus, etc., employed, and the quantity and value of the products of the fisheries of Louisiana in 1897.

Persons employed.

How engaged.	No.
On vessels fishing	80
On vessels transporting	63
In shore or boat fisheries	3, 576
Shoresmen	684
Total	4, 403

Table of apparatus and capital.

Items.	No.	Value.	Items.	No.	Value.
Vessels fishing	31	$15, 006	Apparatus—shore fisheries:		
Tonnage	198. 57		Seines	135	$12, 156
Outfit		3, 945	Fyke nets	188	940
Vessels transporting	30	17, 095	Minor apparatus		2, 539
Tonnage	197. 23		Lines		7, 971
Outfit		5, 600	Tongs	1, 563	7, 615
Boats fishing	3, 008	191, 114	Shore and accessory property		173, 903
Boats transporting	17	6, 490	Cash capital		69, 000
Apparatus—vessel fisheries:					
Seines	1	55			
Tongs	76	384	Total		513, 813

Table of products.

Species.	Lbs.	Value.	Species.	Lbs.	Value.
Black bass	320	$26	Silver perch	3, 015	$128
Blue-fish	3, 960	132	Spanish mackerel	55, 805	5, 132
Buffalo-fish	311, 093	4, 768	Striped bass	22, 880	1, 449
Cat-fish	2, 153, 134	51, 420	Sun-fishes	119, 780	3, 789
Channel bass or red-fish	465, 200	20, 529	Trout	566, 648	26, 500
Crevalle	18, 000	690	Other fish	66, 550	3, 583
Croakers	328, 775	16, 980	Oysters	[1]6, 714, 330	432, 668
Drum, fresh-water	7, 250	74	Shrimp	4, 486, 726	80, 576
Drum, salt-water	18, 570	540	Crabs	[2]1, 458, 833	12, 891
Flounders	9, 625	654	Craw-fish	84, 950	3, 113
Hog-fish	125	5	Terrapin	41, 680	4, 149
Mullet	165, 819	5, 871	Turtle	22, 395	581
Perch	11, 050	500	Alligator hides	(3)	22, 096
Pompano	17, 665	1, 891			
Sheepshead	238, 010	12, 506	Total	17, 401, 788	713, 587
Shoemaker	9, 600	346			

[1] Represents 383,676 barrels or 959,190 bushels.

[2] Represents 4,376,500 in number.

[3] Represents 41,092 in number.

The fishermen of Louisiana are largely of foreign birth, and in a majority of cases have little attachment to the places where they camp, moving from place to place according to the productiveness of the fisheries in the various localities. For this reason it is extremely difficult to report the extent of the fisheries of each parish or county separately, but for the purpose of securing uniformity in presenting the figures for all the Gulf States, the following five tables are arranged to show by parishes the number of persons employed, the quantity and value of boats, apparatus, etc., and the weight and value of the product. The last two tables are intended to represent the yield in the vessel fisheries and in the shore fisheries separately. It must not be understood, however, that there is any difference in the so-called "vessel fisheries" and the shore or boat fisheries of this State, for their characteristics are identical, and there is probably no sail craft employed in the fisheries of Louisiana large enough to be listed at the custom-house if measured according to the present regulations.

Table showing the number of persons employed in the fisheries of Louisiana in 1897.

Parishes or counties.	On vessels fishing.	On vessels transporting.	Shore or boat fishermen.	Shoresmen.	Total.
Calcasieu			8		8
Cameron			7		7
Jefferson		4	422	24	450
Lafourche	2		362		364
Orleans	18		415	370	803
Plaquemines			494		494
St. Bernard			158		158
St. Charles			140		140
St. John the Baptist			32		32
St. Landry[1]			342	15	357
St. Mary[2]	37	47	576	161	821
St. Tammany			34		34
Tangipahoa			26		26
Terrebonne	23	12	555	114	704
Vermilion			5		5
Total	80	63	3,576	684	4,403

[1] Includes the parishes Pointe Coupée, Iberville, Avoyelles, and a portion of St. Martin.
[2] Includes the parishes of Assumption, Iberia, and portions of Iberville and St. Martin.

Table showing by counties the vessels, boats, and apparatus employed in the fisheries of Louisiana in 1897.

Items.	Calcasieu.		Cameron.		Jefferson.		Lafourche.		Orleans.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing							1	$400	4	$1,935
Tonnage							5.73		28.78	
Outfit								100		1,060
Vessels transporting					2	$700				
Tonnage					12.20					
Outfit						200				
Boats fishing	12	$225	10	$260	180	24,432	227	21,455	231	27,405
Boats transporting					3	825				
Apparatus—vessel fisheries:										
Seines										
Tongs							2	12	18	90
Apparatus—shore fisheries:										
Seines					34	5,200	11	1,770	46	2,210
Minor apparatus						485				742
Lines		45		40		640				120
Tongs			5	25	53	165	292	1,465	123	615
Shore and accessory property		75		20		24,160		5,500		95,100
Cash capital						5,500				30,000
Total		345		345		62,307		30,702		159,277

Table showing by counties the vessels, boats, and apparatus employed in the fisheries of Louisiana in 1897—Continued.

Items.	Plaquemines.		St. Bernard.		St. John Baptist.		St. Charles.		St. Landry.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats fishing	674	$61, 810	151	$2, 415	108	$1, 684	30	$540	355	$3, 240
Boats transporting									14	5, 665
Apparatus—shore fisheries:										
Seines			17	1, 870	4	195	9	310		
Fyke nets									188	940
Minor apparatus		83		566		273		165		
Lines		120		240		120		30		1, 536
Tongs	488	2, 340								
Shore and accessory property		13, 150		260		300		150		5, 813
Cash capital										4, 300
Total		77, 503		5, 351		2, 572		1, 195		21, 494

Items.	St. Mary.		St. Tammany.		Tangipahoa.		Terrebonne.		Vermilion.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	16	$7, 260					10	$5, 411		
Tonnage	98. 56						65. 50			
Outfit		1, 685						1, 100		
Vessels transporting	22	14, 745					6	1, 650		
Tonnage	148. 21						36. 82			
Outfit		4, 800						600		
Boats fishing	539	11, 368	23	$805	20	$455	444	34, 895	4	$125
Apparatus—vessel fisheries:										
Seines	1	55								
Tongs	33	165					23	117		
Apparatus—shore fisheries:										
Seines	2	136	3	110	2	80	7	275		
Minor apparatus		50		67		38		70		
Lines		4, 970		48		22				40
Tongs	64	320					537	2, 685		
Shore and accessory property		16, 765		100		60		12, 450		
Cash capital		19, 500						9, 700		
Total		81, 819		1, 130		655		68, 953		165

SUMMARY.

Items.	No.	Value.
Vessels fishing	31	$15, 006
Tonnage	198. 57	
Outfit		3, 945
Vessels transporting	30	17, 095
Tonnage	197. 23	
Outfit		5, 600
Boats fishing	3, 008	191, 114
Boats transporting	17	6, 490
Apparatus—vessel fisheries:		
Seines	1	55
Tongs	76	384
Apparatus—shore fisheries:		
Seines	135	$12, 156
Fyke nets	188	940
Minor apparatus		2, 539
Lines		7, 971
Tongs	1, 563	7, 615
Shore and accessory property		173, 903
Cash capital		69, 000
Total		513, 813

Table showing by counties and species the yield of the fisheries of Louisiana in 1897.

Species.	Calcasieu.		Cameron.		Jefferson.		Lafourche.		Orleans.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black bass									320	$26
Blue cat									3,460	112
Buffalo-fish					7,400	$148	28,900	$578	27,090	514
Cat-fish	30,850	$582	4,000	$120	149,600	3,220	12,800	384	59,420	1,627
Channel bass or red-fish					54,125	2,585	22,030	1,080	266,705	11,745
Crevalle									18,000	690
Croakers					23,820	1,347	5,400	221	154,915	7,743
Drum, salt-water									16,170	420
Flounders									5,325	399
Mullet					92,560	3,063	38,685	1,567	12,274	400
Perch			2,800	84	2,650	78				
Pompano									17,100	1,805
Sheepshead					12,000	699	1,960	126	127,735	6,390
[illegible]									9,600	346
Silver perch									2,870	110
Spanish mackerel					3,260	326	950	95	47,710	4,326
Striped bass					720	49			4,340	277
Sun-fishes			28,750	512	7,170	293			45,630	1,341
Trout					157,795	7,549	56,590	2,862	175,215	7,432
Other fish					17,200	951	7,200	294	13,500	755
Oysters			19,250	870	186,900	10,142	882,910	49,601	1,076,425	44,358
Shrimp					3,322,466	54,837	928,160	21,386	24,100	584
Crabs					975,867	6,179			320,000	4,120
Craw-fish					29,500	670			21,350	913
Terrapins					1,375	58				
Turtles					6,850	177			2,600	61
Alligators						4,257		5,243		
Total	30,850	582	54,800	1,586	5,053,458	96,628	1,985,585	83,437	2,451,854	96,494

Species.	Plaquemines.		St. Bernard.		St. Charles.		St. John Baptist.		St. Landry.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Buffalo-fish	11,000	$220	6,000	$104	23,750	$480	37,000	$740	148,273	$1,583
Cat-fish	123,600	2,472	49,700	1,066	47,500	1,014	57,150	1,482	588,831	13,586
Channel bass or red-fish	4,000	20	44,360	2,290	1,000	75	300	21		
Croakers	7,100	304	36,000	1,152	19,450	1,145	28,570	2,165		
Drum, fresh-water									7,250	74
Drum, salt-water			2,400	120						
Flounders			4,000	240						
Mullet			11,500	460	5,200	198	3,650	138		
Perch			5,600	338						
Pompano			500	60						
Sheepshead	2,000	12	59,180	3,594	3,360	267	4,300	314		
Spanish mackerel			3,650	365	100	12				
Striped bass			14,900	904	400	32	1,600	117		
Sun-fishes	1,100	33	13,700	437	4,780	278	6,250	417		
Trout	3,000	15	78,240	4,273	10,530	728	12,920	804		
Other fish			12,800	660	3,800	208	4,600	296		
Oysters	1,685,880	163,607								
Shrimp	36,000	740	52,000	1,140						
Crabs			132,900	2,140			9,000	138		
Craw-fish			9,600	380	15,000	510	18,500	640		
Turtles			4,620	137			3,200	74		
Total	1,873,680	167,423	541,650	19,860	134,870	4,947	187,040	7,346	744,354	15,243

Table showing by counties and species the yield of the fisheries of Louisiana in 1897—Cont'd.

Species.	St. Mary.		St. Tammany.		Tangipahoa.		Terrebonne.		Vermillion.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Blue-fish	500	$20								
Buffalo-fish	4, 620	118	2, 960	$59	4, 100	$84	10, 000	$140		
Cat-fish	979, 093	24, 516	18, 280	602	9, 910	301			22, 400	$448
Channel bass or red-fish	35, 900	1, 413	1, 870	140			34, 910	1, 160		
Croakers	3, 880	155	20, 990	1, 669	12, 040	715	10, 610	364		
Flounders			300	15						
Hog-fish	75	3					50	2		
Mullet	1, 050	21	300	12			600	12		
Pompano	65	26								
Sheepshead	8, 520	341	2, 600	198	1, 455	99	14, 900	466		
Silver perch							145	18		
Spanish mackerel	75	3					60	5		
Striped bass			920	70						
Sun-fishes	1, 800	36	2, 760	174	1, 790	99	1, 250	25	4, 800	144
Trout	23, 860	948	5. 020	355	4, 785	326	38, 693	1, 208		
Other fish			4, 250	249	3, 200	170				
Oysters	389, 585	22, 712					2, 473, 380	141, 378		
Shrimp	57, 800	1, 136					60, 200	753		
Crabs			16, 533	240	5, 333	74				
Terrapins	14, 757	2, 123					25, 548	1, 968		
Turtles			3, 200	84	1, 800	44	125	4		
Alligators		5, 816						6, 780		
Total	1,521, 580	59, 387	79, 983	3, 867	44, 413	1, 912	2, 670, 471	154, 283	27, 200	592

SUMMARY.

Species.	Lbs.	Value.	Species.	Lbs.	Value.
Black bass	320	$26	Silver perch	3, 015	$128
Blue-fish	3, 960	132	Spanish mackerel	55, 805	5, 132
Buffalo-fish	311, 093	4, 768	Striped bass	22, 880	1, 449
Cat-fish	2, 153, 134	51, 420	Sun-fishes	119, 780	3, 789
Channel bass or red-fish	465, 200	20, 529	Trout	566, 648	26, 500
Crevalle	18, 000	690	Other fish	66, 550	3, 583
Croakers	328, 775	16, 980	Oysters	6, 714, 330	432, 668
Drum, fresh-water	7, 250	74	Shrimp	4, 486, 726	80, 576
Drum, salt-water	18, 570	540	Crabs	1, 458, 833	12, 891
Flounders	9, 625	654	Craw fish	84, 950	3, 113
Hog-fish	125	5	Terrapins	41, 680	4, 149
Mullet	165, 819	5, 871	Turtles	22, 395	581
Perch	11, 050	500	Alligator		22, 096
Pompano	17, 665	1, 891			
Sheepshead	238, 010	12, 506	Total	17, 401, 788	713, 587
Shoemaker	9, 600	346			

Table showing by counties, apparatus, and species the yield of the vessel fisheries of Louisiana in 1897.

Apparatus and species.	Lafourche.		Orleans.		St. Mary.		Terrebonne.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:										
Channel bass or red-fish					6, 150	$246			6, 150	$246
Croakers					180	7			180	7
Mullet					150	3			150	3
Sheepshead					1, 120	45			1, 120	45
Trout					4, 060	162			4, 060	162
Shrimp					1, 800	36			1, 800	36
Total					13, 460	499			13, 460	499
Tongs:										
Oysters	11, 060	$627	98, 875	$4, 331	119, 910	6, 852	93, 030	$5, 316	322, 875	17, 126
Grand total	11, 060	627	98, 875	4, 331	133, 370	7, 351	93, 030	5, 316	336, 335	17, 625

Table showing by counties, apparatus, and species the yield of the shore fisheries of Louisiana in 1897.

Apparatus and species.	Calcasieu.		Cameron.		Jefferson.		Lafourche.		Orleans.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:										
Black bass									320	$26
Blue-fish									3,460	112
Buffalo-fish					7,400	$148	28,900	$578	27,090	514
Cat-fish					9,000	240	12,800	384	40,120	1,003
Channel bass or red-fish					54,125	2,585	22,030	1,080	266,585	11,736
Crevalle									18,000	690
Croakers					26,020	1,224	5,400	221	127,415	6,593
Drum, salt-water									16,170	420
Flounders									5,325	399
Mullet					88,360	2,924	38,685	1,567	7,124	218
Pompano									17,100	1,805
Sheepshead					8,900	491	1,960	126	123,605	6,094
Shoemaker									9,600	346
Silver perch									2,870	110
Spanish mackerel					2,460	246	950	95	44,860	4,014
Striped bass					320	21			3,440	207
Sun-fishes					1,470	86			43,230	1,213
Trout					141,485	6,558	56,590	2,862	162,355	6,544
Other fish					11,200	612	7,200	294	9,500	520
Shrimp					3,328,466	54,837	928,160	21,386		
Total					3,679,206	69,972	1,102,675	28,593	928,169	42,564
Minor apparatus:										
Cat-fish					6,200	136			4,200	128
Mullet					4,200	139			4,150	137
Trout					2,200	132			2,000	145
Sun-fishes					1,700	87			600	36
Other fish					2,000	114			2,000	100
Shrimp									24,100	584
Crabs					10,667	167			320,000	4,120
Craw-fish					20,500	670			21,350	913
Terrapins					1,375	58				
Turtles					6,850	177			2,600	61
Alligator hides						4,257		5,243		
Total					55,692	5,937		5,243	381,000	6,224
Lines:										
Cat-fish	30,850	$582	4,000	$120	134,400	2,844			15,100	496
Channel bass or red-fish									120	9
Croakers					3,800	123			27,500	1,150
Mullet									1,000	45
Perch			2,800	84	2,650	78				
Sheepshead					3,100	208			4,130	296
Spanish mackerel					800	80			2,850	312
Striped bass					400	28			900	70
Sun-fishes			28,750	512	4,000	120			1,800	92
Trout					14,110	859			10,860	743
Other fish					4,000	225			2,000	135
Crabs					964,400	6,012				
Total	30,850	582	35,550	716	1,131,660	10,577			66,260	3,348
Tongs:										
Oysters			19,250	870	186,900	10,142	871,850	48,974	977,550	40,027
Grand total	30,850	582	54,800	1,586	5,053,458	96,628	1,974,525	82,810	2,352,979	92,163

Table showing the yield of the shore fisheries of Louisiana in 1897—Continued.

Apparatus and species.	Plaquemines.		St. Bernard.		St. Charles.		St. John Baptist.		St. Landry.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Val.	Lbs.	Value.	Lbs.	Val.
Seines:										
Buffalo-fish			6, 000	$104	23, 750	$480	37, 000	$740		
Cat-fish			17, 600	394	21, 000	465	31, 000	798		
Channel bass or red-fish			44, 360	2, 290	1, 000	75	300	21		
Croakers			29, 500	892	14, 050	783	28, 570	2, 165		
Drum, salt-water			2, 400	120						
Flounders			4, 000	240						
Mullet			9, 000	360	2, 000	70	2, 000	80		
Perch			5, 600	338						
Pompano			500	60						
Sheepshead			53, 000	3, 220	1, 200	84	1, 500	90		
Spanish mackerel			2, 000	200	100	12				
Striped bass			10, 700	644	400	32	1, 000	75		
Sun-fishes			12, 400	372	2, 400	144	4, 250	297		
Trout			68, 000	3, 560	4, 160	318	2, 180	168		
Other fish			8, 000	400	2, 000	100	2, 000	140		
Shrimp			52, 000	1, 140						
Total			325, 060	14, 334	72, 060	2, 563	109, 800	4, 574		
Fyke nets:										
Buffalo-fish									148, 273	$1, 583
Cat-fish									10, 870	254
Drum, fresh-water									7, 250	74
Total									166, 393	1, 911
Minor apparatus:										
Buffalo-fish	11, 000	$220								
Cat-fish	2, 000	40	8, 100	162	2, 500	54	7, 400	210		
Channel bass or red-fish	4, 000	20								
Croakers	2, 000	100								
Mullet			2, 500	100	2, 000	80	1, 650	58		
Striped bass			2, 000	100						
Sun-fishes			1, 000	50	1, 000	50	2, 000	120		
Trout					1, 500	90	1, 200	66		
Other fish			1, 800	90	1, 000	60	1, 400	80		
Shrimp	36, 000	740								
Crabs			132, 900	2, 140			9, 000	138		
Craw-fish			9, 600	380	15, 000	510	18, 500	640		
Turtles			4, 620	137			3, 200	74		
Total	55, 000	1, 120	162, 520	3, 159	23, 000	844	44, 350	1, 386		
Lines:										
Cat-fish	121, 600	2, 432	24, 000	510	24, 000	495	18, 750	474	577, 961	13, 332
Croakers	5, 100	204	6, 500	260	5, 400	362				
Mullet					1, 200	48				
Sheepshead	2, 000	12	6, 180	374	2, 160	183	2, 800	224		
Spanish mackerel			1, 650	165						
Striped bass			2, 200	160			600	42		
Sun-fishes	1, 100	33	300	15	1, 380	84				
Trout	3, 000	15	10, 240	713	4, 870	320	9, 540	570		
Other fish			3, 000	170	800	48	1, 200	76		
Total	132, 800	2, 696	54, 070	2, 367	39, 810	1, 540	32, 890	1, 386	577, 961	13, 332
Tongs:										
Oysters	1, 685, 880	163, 607								
Grand total	1, 873, 680	167. 423	541, 650	19, 860	134, 870	4, 947	187, 040	7, 346	744, 354	15, 243

Table showing the yield of the shore fisheries of Louisiana in 1897—Continued.

Apparatus and species.	St. Mary.		St. Tammany.		Tangipahoa.		Terrebonne.		Vermilion.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Val.
Seines:										
Blue-fish	500	$20								
Buffalo-fish			2,960	$59	4,100	$84	10,000	$140		
Cat-fish			8,120	258	5,260	158				
Channel bass or red-fish	29,750	1,167	1,870	140			34,910	1,160		
Croakers	3,700	148	12,350	984	9,865	585	10,610	364		
Flounders			300	15						
Hog-fish	75	3					50	2		
Mullet	900	18	300	12			600	12		
Pompano	65	26								
Sheepshead	7,400	296	800	62	615	47	14,900	466		
Silver perch							145	18		
Spanish mackerel	75	3					60	5		
Striped bass			920	70						
Sun-fishes	1,800	36	1,610	104	1,370	78	1,250	25		
Trout	19,800	786	960	57	500	25	38,693	1,208		
Other fish			2,000	110	1,600	90				
Shrimp	32,000	640					60,200	753		
Terrapins	143	21					1,068	96		
Turtles							125	4		
Total	96,208	3,164	32,190	1,871	23,310	1,067	172,611	4,253		
Minor apparatus:										
Cat-fish			1,100	32	800	22				
Trout			500	30	300	17				
Sun-fishes			600	37	420	21				
Other fish			750	45	600	30				
Shrimp	24,000	460								
Crabs			16,533	240	5,333	74				
Terrapins	14,614	2,102					24,480	1,872		
Turtles			3,200	84	1,800	44				
Alligator hides		5,816						6,780		
Total	38,614	8,378	22,683	468	9,253	208	24,480	8,652		
Lines:										
Buffalo-fish	4,620	118								
Cat-fish	979,093	24,516	9,060	312	3,850	121			22,400	$448
Croakers			8,640	685	2,175	130				
Sheepshead			1,800	136	840	52				
Trout			3,560	268	3,985	284				
Sun-fishes			550	33					4,800	144
Other fish			1,500	94	1,000	50				
Total	983,713	24,634	25,110	1,528	11,850	637			27,200	592
Tongs:										
Oysters	269,675	15,860					2,380,350	136,062		
Grand total	1,388,210	52,036	79,983	3,867	44,413	1,912	2,577,441	148,967	27,200	592

Table showing the yield of the shore fisheries of Louisiana in 1897—Continued.

SUMMARY.

Apparatus and species.	Lbs.	Value.
Seines:		
Black bass	320	$26
Blue-fish	3, 960	132
Buffalo-fish	147, 200	2, 847
Cat-fish	144, 900	3, 700
Channel bass or red-fish	454, 930	20, 254
Crevalle	18, 000	690
Croakers	267, 480	13, 959
Drum, salt-water	18, 570	540
Flounders	9, 625	654
Hog-fish	125	5
Mullet	148, 969	5, 261
Perch	5, 600	338
Pompano	17, 665	1, 891
Sheepshead	213, 880	10, 976
Shoemaker	9, 600	346
Silver perch	3, 015	128
Spanish mackerel	50, 505	4, 575
Striped bass	16, 780	1, 049
Sun-fishes	69, 780	2, 355
Trout	494, 723	22, 086
Other fish	43, 500	2, 266
Shrimp	4, 400, 826	78, 756
Terrapins	1, 211	117
Turtles	125	4
Total	6, 541, 289	172, 955
Fyke nets:		
Buffalo-fish	148, 273	1, 583
Cat-fish	10, 870	254
Drum, fresh-water	7, 250	74
Total	166, 393	1, 911
Tongs:		
Oysters	6, 391, 455	415, 542
Minor apparatus:		
Buffalo-fish	11, 000	$220
Cat-fish	32, 300	784
Channel bass or red-fish	4, 000	20
Croakers	2, 000	100
Mullet	14, 500	514
Striped bass	2, 000	100
Sun-fishes	7, 320	401
Trout	7, 700	480
Other fish	9, 550	519
Shrimp	84, 100	1, 784
Crabs	494, 433	6, 879
Craw-fish	84, 950	3, 113
Terrapins	40, 469	4, 032
Turtles	22, 270	577
Alligator hides	....	22, 096
Total	816, 592	41, 619
Lines:		
Buffalo-fish	4, 620	118
Cat-fish	1, 965, 064	46, 682
Channel bass or red-fish	120	9
Croakers	59, 115	2, 914
Mullet	2, 200	93
Perch	5, 450	162
Sheepshead	23, 010	1, 485
Spanish mackerel	5, 300	557
Striped bass	4, 100	300
Sun-fishes	42, 680	1, 033
Trout	60, 165	3, 772
Other fish	13, 500	798
Crabs	964, 400	6, 012
Total	3, 149, 724	63, 935
Grand total	17, 065, 453	695, 962

Only about one-third of the fishery products of Louisiana enter into the wholesale trade, the remaining two-thirds being sold direct from the boats to the retail merchants and consumers. The wholesale oyster trade is centered at Morgan City and Houma. The trade in oysters at New Orleans is more extensive than at Morgan City and Houma combined, but it is almost exclusively retail and very few are shipped from that city. The trade at Morgan City originated about 1880 and at Houma in 1889. The business at the latter point fell off on account of depleted beds, but was revived in 1896. Nearly all the oysters received are opened and shipped throughout the West. The extent of the business at each point during 1897 was reduced by the quarantine regulations during October and November.

The great bulk of the shrimp caught in Louisiana are sold to the Chinese driers in the Barataria section, to the canners in New Orleans, and to the retail trade in New Orleans, only a small proportion being consumed in the fishing settlements. In the Barataria section there are three Chinese camps devoted to drying shrimp, principally for export to the Orient. This industry was begun in 1873 and although badly affected by the storm of 1893, and by serious competition with a similar business in Mexico, yet it is still in fairly prosperous condition. In 1897 these camps received 1,331,736 pounds of fresh shrimps, costing $10,304, which yielded 142,510 pounds of dried, worth $21,185. They also prepared 61,147 pounds of dried fish, using 142,510 pounds of miscellaneous fresh fish, but most of the fish-drying was done by them at temporary camps on Timbalier Island.

The wholesale cat-fish trade is conducted at Morgan City, Melville, and the village of Plaquemine. The trade originated at Morgan City in 1873 and reached its maximum in 1893. The origin of the trade at Melville followed shortly after the completion of the Texas and Pacific Railroad through that place, and that at Plaquemine dates only from 1897. During the year covered by this report the gross weight of cat-fish received at Morgan City was about 842,575 pounds; at Melville, 367,402 pounds, and at Plaquemine, 70,483 pounds, in addition to which there was a small quantity of other species received at each point.

The following table shows the extent of the wholesale business at each place in 1897:

Table showing the wholesale trade in fishery products for Louisiana in 1897.

Items.	Morgan City.	Houma.	Barataria section.	New Orleans and elsewhere.	Total.
Establishments	4	5	3	8	20
Value	$11, 085	$9, 450	$20, 500	$71, 805	$112, 840
Cash capital	$19, 500	$9, 700	$5, 500	$34, 300	$69, 000
Employees	161	114	24	199	498
Products received:					
Oysters ... barrels	95, 834	84, 468			180, 302
Value	$84, 039	$84, 468			$168, 507
Shrimp ... pounds			1, 331, 736	1, 142, 360	2, 474, 096
Value			$10, 304	$22, 847	$33, 151
Cat-fish ... pounds	842, 575			639, 212	1, 481, 887
Value	$21, 064			$14, 384	$35, 448
Buffalo-fish ... pounds				129, 158	129, 158
Value				$1, 382	$1, 382
Other fish ... pounds			142, 510		142, 510
Value			$1, 833		$1, 833
Products as sold:					
Number of oysters sold opened	28, 897, 490	33, 787, 250			62, 684, 740
Value	$131, 639	$136, 587			$268, 226
Number of cans of oysters prepared	401, 160				401, 160
Value	$20, 198				$20, 198
Pounds of shrimp dried			141, 413		141, 413
Value			$21, 185		$21, 185
Number of cans of shrimp prepared				421, 264	421, 264
Value				$59, 876	$59, 876
Pounds of cat-fish ... dressed wgt	577, 106			437, 885	1, 014, 991
Value	$32, 487			$24, 219	$56, 706
Pounds of buffalo-fish ... dressed wgt				88, 464	88, 464
Value				$2, 678	$2, 678
Pounds of other fish dried			61, 147		61, 147
Value			$2, 956		$2, 956

FISHERIES OF TEXAS.

The fisheries of Texas are confined almost exclusively to the coastal indentations and their estuaries. In the Gulf of Mexico very few fish are caught, the only important fishery prosecuted there being the taking of red snappers. The principal fisheries in the bays are seining and oystering, while associated with these and of less importance are the use of green turtle nets, cast nets, lines, spears, etc. The history and method of the fisheries and the fishery resources of Texas were described in considerable detail in the report of the U. S. Fish Commission for 1891, to which reference should be made.[1]

The general condition of the fisheries in 1897 did not compare favorably with that of 1890, there being a decrease at nearly all points except Matagorda Bay and Sabine Lake. The persons employed numbered 1,277 in 1890 as against 1,199 in 1897. The value of vessels, boats, apparatus, shore property, etc., decreased from $319,122 to $237,496, the reduction being greatest in the case of shore property and cash capital. The value of the products in 1890 was $313,832 against $286,610 in 1897. In 1880 the persons employed numbered 601; the capital invested, $42,400, and the value of the products, $128,300. The greatest decrease in products in 1897 is noticed in the case of oysters, but nearly all the fisheries show some falling-off since 1890.

A noticeable exception to this is the yield of red snappers, of which only 4,800 pounds were obtained in 1890, whereas the product in 1897 approximated 464,791 pounds, valued at $17,451. Prior to 1892 the red-snapper fishery was of little value in Texas, being confined to an occasional trip at odd intervals. Since then an important and profitable fishery has been developed at Galveston, the vessels making weekly trips to the banks south of that port.

The seine fishing is the most valuable and extensive fishery in Texas. The number of seines has increased from 136 in 1890 to 171 in 1897, but the yield shows a falling-off, the catch in 1890 being 3,786,100 pounds, whereas in 1897 it was 3,561,035 pounds; the value being $157,502 in the former year and $143,070 in the latter. The decrease in the yield of the seines is greatest in case of sheepshead, the total yield of that species in 1890 being 759,050 pounds, whereas in 1897 it was but 464,024 pounds. Trout, croakers, and several other species show considerable decrease. On the other hand, the yield of blue-fish, flounders, Spanish mackerel, and shrimp has increased.

The oyster industry shows a much greater decrease since 1890 than the seine fishery. The yield in 1890 aggregated 440,800 bushels, valued at $127,990, whereas in 1897 it was but 355,910 bushels, worth $94,663 at first hands. This is due to business depression in several of the coastal towns and to the failure of the principal attempts made at oyster culture about 1890. The decrease is greatest in Galveston, Aransas, and Corpus Christi bays—the yield in Sabine Lake showing a considerable increase. While some experimental work at oyster culture is now in operation, practically the entire market receipts are from the public reefs. These oysters are shipped raw to the trade throughout the west and southwest and to Mexican points, none of them being steam-canned.

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[1] The Coast Fisheries of Texas, by Charles H. Stevenson, Report U. S. Fish Commission for 1889–1891, pp. 373–420.

The green-turtle fishery has never been of great consequence on the Texas coast, yet its present extent is very much less than formerly, the decrease since 1890 being about 60 per cent. Most of the green turtle are taken by gill nets or fly nets, the percentage taken in seines being very small. Notwithstanding an increase of 10 per cent in number of nets used in 1897 over 1890, the gill-net yield in the two years decreased from 585,000 to 237,385 pounds. The scarcity of green turtle is generally attributed to the vigorous fishery prosecuted along the Mexican coast. Several green-turtle canneries were formerly operated in Texas, but they have been closed on account of the scarcity of turtles, and the product is now placed on the market fresh.

Cast nets, hand lines, spears, and crab traps constitute the minor apparatus employed, and their yield fluctuates from year to year according to the prosperity of other industries along the coast. If the other industries of the coast towns give steady employment to the laborers, the latter spend but little time in fishing with this class of apparatus.

The general extent of the fisheries of Texas in 1897 is presented in the following series of three tables, showing the number of persons engaged, the quantity and value of boats, apparatus, etc., employed, and the weight and value of the catch:

Table of persons employed.

How engaged.	No.
On vessels fishing	175
In shore or boat fisheries	965
On shore, in fish-houses, etc	59
Total	1, 199

Table of apparatus and capital.

Items.	No.	Value.
Vessels fishing	45	$36, 565
Tonnage	508. 81	
Outfit		15, 119
Boats	686	77, 911
Apparatus—vessel fisheries:		
Seines	24	2, 762
Turtle gill nets	22	115
Lines		148
Tongs and rakes	43	255
Apparatus—shore fisheries:		
Seines	147	$15, 517
Turtle gill nets	204	1, 254
Cast nets	158	542
Minor nets	60	20
Lines		393
Spears		52
Tongs and rakes	285	1, 688
Shore and accessory property		55, 155
Cash capital		30, 000
Total		237, 496

Table of products.

Species.	Lbs.	Value.	Species.	Lbs.	Value.
Blue-fish	29, 540	$1, 281	Pompano	17, 850	$812
Buffalo-fish	12, 200	470	Red snapper	464, 791	17, 453
Cat-fish	71, 230	3, 035	Sheepshead	467, 504	21, 723
Channel bass or red-fish	1, 144, 376	51, 922	Spanish mackerel	40, 710	1, 939
Crevalle	18, 000	743	Striped bass	8, 950	384
Croakers	136, 700	6, 007	Sturgeon	22, 400	984
Drum	50, 400	2, 046	Trout	1, 011, 620	45, 525
Flounders	218, 025	9, 819	Other fish	60, 500	2, 646
Groupers	3, 463	84	Shrimp	360, 530	7, 464
Hog-fish	15, 995	784	Crabs	[1]138, 120	3, 689
Jew-fish	33, 281	1, 083	Turtles	237, 385	6, 860
Mullet, fresh	60, 350	2, 167	Terrapins	3, 880	507
Mullet, salted	500	25	Oysters	[2]2, 491, 370	94, 663
Perch	32, 150	1, 506			
Pike	22, 730	989	Total	7, 174, 550	286, 610

[1] Represents 424,360 in number.

[2] Represents 355,910 bushels.

The principal localities where the Texas fisheries are prosecuted are the bays formed between the mainland and the outlying chain of islands and peninsulas, viz, Galveston, Matagorda, Aransas, Corpus Christi, and Laguna Madre; also Sabine Lake, in the extreme eastern part of the State; this, however, is an expansion of the Sabine River rather than a bay. The only important fishery prosecuted outside of these indentations is the red-snapper fishery carried on in the Gulf of Mexico from the port of Galveston.

The most important of these localities from a fishery point of view is Galveston Bay, the value of its fisheries in 1897 approximating $102,772, whereas in 1890 it amounted to $160,869, the decrease being greatest in the yield of oysters, the value of which in 1890 was $72,140 and in 1897 $36,201. The value of the yield by seines in Galveston Bay decreased from $79,909 in 1890 to $60,261 in 1897.

Second in importance to Galveston Bay is Corpus Christi Bay, the value of its fishery yield in 1897 being $52,370, against $45,625 in 1890, the increase being in the yield by seines, due to an increase in the number employed. The value of the oyster product of Corpus Christi Bay in 1890 was $18,350, whereas in 1897 it was $14,977. A noticeable feature of the fisheries of this bay is the large increase in the yield of shrimp, from 10,000 pounds in 1890 to 224,400 pounds in 1897.

The value of the fisheries of Matagorda Bay are only slightly less than those of Corpus Christi, amounting to $51,328 in 1897. This is a great improvement over 1890, when the value was but $33,693. The increase has occurred principally in the seine fishery, the value of which in 1890 amounted to $3,593 and in 1897 to $25,358, the number of seines used increasing in the same time from 5 to 29. The oyster yield of Matagorda Bay was 109,350 bushels, worth $29,200 in 1890, and 95,816 bushels, valued at $23,768, in 1897. The fishery resources of Matagorda Bay are second to none on the Texas coast, their present minor rank being due to lack of sufficient transportation facilities, although they are now very much better than in 1890. Port Lavaca is the shipping-point for the products of this bay.

The fisheries of Aransas Bay show a considerable falling-off since 1890, when its rank was second among the Texas bays, the value amounting to $62,822, against $36,236 in 1897. The decrease is most apparent in the seine fishery, the 29 seines used in 1890 yielding 1,244,100 pounds of fish, worth $43,562; whereas in 1897 the yield in the 28 seines was but 638,636 pounds, for which the fishermen received $26,009. The oyster yield of Aransas Bay in 1890 was 26,550 bushels, worth $6,600, and in 1897 it was increased to 28,700 bushels, valued at $6,872.

The fisheries of Sabine Lake have developed considerably during recent years, increasing in value from $4,038 in 1890 to $12,530 in 1897, due principally to the utilization of the oyster reefs at the lower end of the lake, which yielded 32,164 bushels in 1897 and many more than that in 1898. The fisheries of the lower end of Laguna Madre and of several other points on the coast are of minor importance, due to lack of suitable transportation facilities.

The following tables show in detail the extent of the fisheries of each of the above-mentioned localities, the figures being presented by counties. The counties which border Galveston Bay are Galveston, Harris, and Chambers; the fisheries of Matagorda Bay are prosecuted from Matagorda and Calhoun counties, those of Aransas Bay from Aransas County, Corpus Christi Bay from Nueces County, Laguna Madre from Cameron County, and Sabine Lake from Jefferson County. The Brazoria County fisheries are prosecuted in Brazos River and in West Bay, and the red-snapper fishery of Galveston County in the Gulf of Mexico.

Table showing the number of persons employed in the fisheries of Texas in 1897.

Counties.	On vessels fishing.	Boat or shore fishermen.	Shoresmen.	Total.
Aransas	10	173	7	190
Brazoria		22		22
Calhoun	36	92	17	145
Cameron		27	2	29
Chambers		19		19
Galveston	61	387	19	467
Harris	16	33		49
Jefferson		48		48
Matagorda	17	22		39
Nueces	35	142	14	191
Total	175	965	59	1,199

Table showing by counties the vessels, boats, and apparatus employed in the fisheries of Texas in 1897.

Items.	Aransas.		Brazoria.		Calhoun.		Cameron.		Chambers.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	3	$1,900			10	$5,650				
Tonnage	23.25				81.10					
Outfit		921				3,126				
Boats	98	12,855	22	$2,504	65	8,834	20	$1,370	18	$2,058
Apparatus—vessel fisheries:										
Seines	2	220			9	1,000				
Turtle nets	17	85			5	30				
Tongs and rakes					12	72				
Apparatus—shore fisheries:										
Seines	26	3,028	4	340	18	1,920	7	540	3	348
Turtle nets	48	270			66	330	6	24		
Cast nets	24	82			24	82	10	30		
Lines		30						70		
Spears		10								
Tongs and rakes	22	132	12	72	16	80	6	30	9	54
Shore and accessory property		6,820		56		10,840		570		54
Cash capital		9,000				13,000				
Total		35,353		2,972		44,964		2,634		2,514

Items.	Galveston.		Harris.		Jefferson.		Matagorda.		Nueces.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	13	$16,820	5	$2,850			7	$4,420	7	$4,925
Tonnage	252.35		44.07				57.54		50.50	
Outfit		4,894		1,665				1,801		2,712
Boats	304	35,617	25	2,755	52	$3,596	26	2,002	56	6,320
Apparatus—vessel fisheries:										
Seines	2	260	3	365			1	112	7	805
Lines		148								
Tongs and rakes	10	60	4	24			14	84	3	15
Apparatus—shore fisheries:										
Seines	62	6,470	10	956	4	510	1	100	12	1,305
Turtle nets									84	630
Cast nets	60	220							40	128
Minor nets	60	20								
Lines		173				105				15
Spears		27								15
Tongs and rakes	157	942	4	24	21	126	18	108	20	120
Shore and accessory property		23,986		162		467		100		12,100
Cash capital		2,000								6,000
Total		91,637		8,801		4,801		8,727		35,090

SUMMARY.

Items.	No.	Value.	Items.	No.	Value.
Vessels fishing	45	$36,565	Apparatus—shore fisheries:		
Tonnage	508.81		Seines	147	$15,517
Outfit		15,119	Turtle nets	204	1,254
Boats	686	77,911	Cast nets	158	542
			Minor nets	60	20
Apparatus—vessel fisheries:			Lines		393
Seines	24	2,762	Spears		52
Turtle nets	22	115	Tongs and rakes	285	1,688
Lines		148	Shore and accessory property		55,155
Tongs and rakes	43	255	Cash capital		30,000
			Total		237,496

Table showing by counties and species the yield of the fisheries of Texas in 1897.

Species.	Aransas.		Brazoria.		Calhoun.		Cameron.		Chambers.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Blue-fish	9, 300	$380	400	$20	6, 400	$265	2, 000	$70	250	$14
Cat-fish	11, 000	495					21, 000	1, 050		
Channel bass	239, 616	9, 849	14, 000	630	228, 210	9, 574	35, 240	1, 246	14, 860	852
Crevalle	3, 200	97			2, 800	110	1, 000	30		
Croakers	7, 650	304	2, 000	80	24, 600	948	5, 000	150	3, 400	170
Drum	2. 450	75							1, 600	80
Flounders	55, 500	2, 236	1, 000	45	29, 850	1, 221	4, 600	161	800	48
Hog-fish	2, 480	106			3, 825	163				
Jew-fish	13, 300	535								
Mullet, fresh	23, 900	813	800	32	3, 050	105	6, 000	180		
Mullet, salted									500	25
Perch	3, 500	140	700	30	9, 050	369	1, 200	36	800	44
Pike	1, 000	40			1, 130	45				
Pompano	6, 900	308	200	12	5, 470	255				
Sheepshead	80, 500	3, 309	7, 600	308	79, 574	3, 332			6, 000	342
Spanish mackerel	9, 600	414			7, 500	339	4, 000	160	300	24
Striped bass	2, 250	94			1, 300	54	2, 000	80		
Sturgeon							22, 400	984		
Trout	200, 350	8, 192	10, 000	490	152, 350	6, 387	33, 800	1, 195	9, 170	529
Other fish	15, 000	450	2, 000	80						
Shrimp	3, 710	111	4, 000	120	10, 200	308	45, 200	1, 373	1, 000	40
Crabs	4, 800	192					3, 000	75		
Turtles	25 340	997			47, 355	1, 894	8, 840	265		
Terrapins	830	227								
Oysters	200, 900	6, 872	50, 820	2, 390	268, 002	9, 311	73, 500	2, 100	41, 020	1, 758
Total	923, 076	36, 236	93, 520	4, 237	880, 666	34, 680	268, 780	9, 155	79, 700	3, 926

Species.	Galveston.		Harris.		Jefferson.		Matagorda.		Nueces.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Blue-fish	3, 350	$201	750	$45			320	$16	6, 770	$270
Buffalo-fish					12, 200	$470				
Cat-fish	6, 000	240			33, 230	1, 250				
Channel bass	255, 630	14, 491	73, 620	4, 252	11, 700	654	21, 800	894	249, 700	9, 480
Crevalle	6, 600	331	1, 400	70					3, 000	105
Croakers	51, 800	2, 575	15, 750	819	1. 200	60	2, 200	88	23, 100	813
Drum	22, 550	941	5, 900	300	1, 000	45			16, 900	605
Flounders	54, 125	3, 209	7, 050	434	200	12	2, 650	110	62, 250	2, 343
Groupers	3, 463	84								
Hog-fish	4, 950	297	1, 500	90			240	10	3, 000	118
Jew-fish	19, 981	548								
Mullet, fresh	15, 800	670	1, 200	60					9, 600	307
Perch	9, 400	564	2, 000	120	400	20	500	22	4, 600	161
Pike	6, 650	364	1, 800	97	250	12			11, 900	431
Pompano	600	48					330	15	4, 350	174
Red snapper	464, 791	17, 453								
Sheepshead	133, 750	7, 550	37, 300	2, 153	4, 980	254	8, 800	360	109, 000	4, 115
Spanish mackerel	3, 600	288	1, 000	80	700	56	1, 400	65	12, 610	513
Striped bass	1, 000	60	200	12			100	4	2, 100	80
Trout	216, 500	12, 522	56, 300	3, 237	5, 300	527	14, 200	580	313, 650	11, 866
Other fish	14, 000	840	4, 500	266	5, 000	270			20, 000	740
Shrimp	65, 000	2, 590	5, 900	214	500	15	620	19	224, 400	2, 674
Crabs	112, 000	2, 800			12, 000	370			6, 320	252
Turtles	34, 800	1, 170	4, 700	180			210	8	116, 140	2, 346
Terrapins	1, 200	120			1, 850	160				
Oysters	721, 420	31, 371	71, 540	3, 072	225, 148	8, 355	402, 710	14, 457	436, 310	14, 977
Total	2,228,960	101, 327	292, 410	15, 501	315, 658	12, 530	456, 080	16, 648	1,635,700	52, 370

SUMMARY.

Species.	Lbs.	Value.	Species.	Lbs.	Value.
Blue-fish	29, 540	$1, 281	Pompano	17, 850	$812
Buffalo-fish	12, 200	470	Red snapper	464, 791	17, 453
Cat-fish	71, 230	3, 035	Sheepshead	467, 504	21, 723
Channel bass	1, 144, 376	51, 922	Spanish mackerel	40, 710	1, 939
Crevalle	18, 000	743	Striped bass	8, 950	384
Croakers	136, 700	6, 007	Sturgeon	22, 400	984
Drum	50, 400	2, 046	Trout	1, 011, 620	45, 525
Flounders	218, 025	9, 819	Other fish	60, 500	2, 646
Groupers	3, 463	84	Shrimp	360, 530	7, 464
Hog-fish	15, 995	784	Crabs	138, 120	3, 689
Jew-fish	33, 281	1, 083	Turtles	237, 385	6, 860
Mullet, fresh	60, 350	2, 167	Terrapins	3, 880	507
Mullet, salted	500	25	Oysters	2, 491, 370	94, 663
Perch	32, 150	1, 506			
Pike	22, 730	989	Total	7, 174, 550	286, 610

Table showing by counties, apparatus, and species the yield of the vessel fisheries of Texas in 1897.

Apparatus and species.	Aransas.		Calhoun.		Galveston.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:						
Blue-fish	1,100	$46	2,400	$105	350	$21
Channel bass or red-fish	37,509	1,571	96,800	4,066	23,000	1,284
Crevalle	200	7	800	30	600	31
Croakers	4,650	184	10,600	408	3,200	160
Drum	450	15			900	45
Flounders	4,500	196	11,950	505	1,800	104
Hog-fish	480	22	1,625	75	450	27
Jew-fish	300	13				
Mullet	2,800	106	550	21		
Perch			4,050	169	500	30
Pike			130	5	650	34
Pompano	900	38	2,470	113		
Sheepshead	9,500	399	32,074	1,347	11,000	620
Spanish mackerel	1,600	72	3,500	159	400	32
Striped bass	1,450	62	300	12		
Trout	27,350	1,146	66,600	2,798	19,600	1,100
Other fish						
Shrimp	150	5	3,200	100	1,000	30
Turtles	2,700	108	695	26	2,800	110
Terrapins	150	67				
Total	95,789	4,057	237,744	9,939	66,250	3,628
Lines:						
Groupers					3,463	84
Jew-fish					18,181	440
Red snappers					464,791	17,453
Total					486,435	17,977
Turtle nets:						
Turtles	8,640	343	8,920	358		
Tongs and rakes:						
Oysters			169,162	6,054	129,080	5,229
Grand total	104,429	4,400	415,826	16,351	681,765	26,834

Apparatus and species.	Harris.		Matagorda.		Nueces.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Blue-fish	350	$21	320	$16	2,570	$102	7,090	$311
Channel bass or red-fish	37,500	2,100	10,800	454	92,700	3,457	298,309	12,932
Crevalle	400	20					2,000	88
Croakers	5,100	274	1,200	48	6,500	231	31,250	1,305
Drum	2,200	115			9,700	353	13,250	528
Flounders	2,250	146	1,450	62	5,550	197	27,500	1,210
Hog-fish	500	30	240	10			3,295	164
Jew-fish							300	13
Mullet					1,600	57	4,950	184
Perch	800	48	500	22	2,000	69	7,850	338
Pike	800	42			5,500	195	7,080	276
Pompano			330	15	2,550	102	6,250	268
Sheepshead	17,700	991	3,800	160	47,000	1,787	121,074	5,304
Spanish mackerel	700	56	400	20	5,310	221	11,910	560
Striped bass	200	12	100	4	900	34	2,950	124
Trout	27,800	1,557	6,200	260	117,350	4,367	264,900	11,228
Other fish	1,500	86					1,500	86
Shrimp	3,400	114	620	19			8,370	268
Turtles	4,700	180	210	8			11,105	432
Terrapins							150	67
Total	105,900	5,792	26,170	1,098	299,230	11,172	831,083	35,686
Lines:								
Groupers							3,463	84
Jew-fish							18,181	440
Red snappers							464,791	17,453
Total							486,435	17,977
Turtle nets:								
Turtles							17,560	701
Tongs and rakes:								
Oysters	42,140	1,812	234,290	8,477	39,200	1,337	613,872	22,909
Grand total	148,040	7,604	260,460	9,575	338,430	12,509	1,948,950	77,273

Table showing by counties, apparatus, and species the yield of the shore fisheries of Texas in 1897.

Apparatus and species.	Aransas.		Brazoria.		Calhoun.		Cameron.		Chambers.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:										
Blue-fish	8,200	$334	400	$20	4,000	$160	2,000	$70	250	$14
Channel bass	196,107	8,038	14,000	630	131,410	5,508	32,640	1,142	14,860	852
Crevalle	3,000	90			2,000	80	1,000	30		
Croakers	3,000	120	2,000	80	12,000	480	5,000	150	3,400	170
Drum	2,000	60							1,600	80
Flounders	19,000	760	1,000	45	14,500	580	4,600	161	800	48
Hog-fish	2,000	84			2,200	88				
Jew-fish	1,000	42								
Mullet, fresh	18,500	630	800	32	2,500	84	3,000	90		
Mullet, salted									500	25
Perch	2,000	80	700	30	5,000	200	1,200	36	800	44
Pike	1,000	40			1,000	40				
Pompano	6,000	270	200	12	3,000	142				
Sheepshead	71,000	2,910	7,600	308	47,500	1,985			6,000	342
Spanish mackerel	8,000	342			4,000	180	4,000	160	300	24
Striped bass	800	32			1,000	42	2,000	80		
Sturgeon							22,400	984		
Trout	169,500	6,906	10,000	490	82,750	3,469	30,500	1,068	9,170	529
Other fish	15,000	450	2,000	80						
Shrimp	2,060	58	4,000	120	4,800	126	41,700	1,251	1,000	40
Turtles	14,000	546			1,600	64	2,000	60		
Terrapins	680	160								
Total	542,847	21,952	42,700	1,847	319,260	13,228	152,040	5,282	38,680	2,168
Turtle nets:										
Turtles					36,140	1,446	6,840	205		
Cast nets:										
Croakers					2,000	60				
Mullet	2,600	77					3,000	90		
Perch	1,500	60								
Trout	3,500	140			3,000	120	1,800	72		
Shrimp	1,500	48			2,200	82	3,500	122		
Total	9,100	325			7,200	262	8,300	284		
Lines:										
Cat-fish	11,000	495					21,000	1,050		
Channel bass	6,000	240					2,600	104		
Jew-fish	12,000	480								
Trout							1,500	55		
Crabs	4,800	192					3,000	75		
Total	33,800	1,407					28,100	1,284		
Spears:										
Flounders	32,000	1,280			3,400	136				
Tongs and rakes:										
Oysters	200,900	6,872	50,820	2,390	98,840	3,257	73,500	2,100	41,020	1,758
Grand total	818,647	31,836	93,520	4,237	464,840	18,329	268,780	9,155	79,700	3,926

Apparatus and species.	Galveston.		Harris.		Jefferson.		Matagorda.		Nueces.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:										
Blue-fish	3,000	$180	400	$24					4,200	$168
Buffalo-fish					12,200	$470				
Cat fish					6,400	286				
Channel bass	228,630	12,967	36,120	2,152	9,600	528	11,000	$440	157,000	6,023
Crevalle	6,000	300	1,000	50					3,000	105
Croakers	48,600	2,415	10,650	545	1,200	60	1,000	40	16,600	582
Drum	21,650	896	3,700	185	1,000	45			7,200	252
Flounders	24,825	1,490	4,800	288	200	12	1,200	48	8,700	322
Hog-fish	4,500	270	1,000	60					3,000	118
Jew-fish										
Mullet, fresh	5,800	270	1,200	60					2,000	70
Perch	6,500	390	1,200	72	400	20			2,600	92
Pike	6,000	330	1,000	55	250	12			6,400	236
Pompano	600	48							1,800	72
Sheepshead	119,750	6,750	19,600	1,162	4,500	225	5,000	200	62,000	2,328
Spanish mackerel	3,200	256	300	24	700	56	1,000	45	7,300	292

Table showing by counties, apparatus, and species the yield of the shore fisheries of Texas in 1897—Continued.

Apparatus and species.	Galveston.		Harris.		Jefferson.		Matagorda.		Nueces.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines—Continued.										
Striped bass	1,000	$60	......	......	......	......	......	......	1,200	$46
Trout	191,100	11,074	28,500	$1,680	3,800	$437	8,000	$320	196,300	7,499
Other fish	10,000	600	3,000	180	1,000	50	......	......	20,000	740
Shrimp	64,000	2,560	2,500	100	500	15	......	......	171,000	1,820
Turtles	32,000	1,060	......	......	......	......	......	......	......	......
Terrapins	1,200	120	......	......	1,850	160	......	......	......	......
Total	778,355	42,036	114,970	6,637	43,600	2,376	27,200	1,093	670,300	20,765
Turtle nets:										
Turtles	......	......	......	......	......	......	......	......	116,140	2,346
Cast nets:										
Mullet	10,000	400	......	......	......	......	......	......	6,000	180
Perch	2,400	144	......	......	......	......	......	......		
Trout	3,000	180	......	......	......	......	......	......	......	......
Shrimp	......	......	......	......	......	......	......	......	53,400	854
Total	15,400	724	......	......	......	......	......	......	59,400	1,034
Minor nets:										
Crabs	112,000	2,800	......	......	......	......	......	......	......	......
Lines:										
Catfish	6,000	240	......	......	26,830	964	......	......	......	......
Channel bass	4,000	240	......	......	2,100	126	......	......	......	......
Jew-fish	1,800	108	......	......	......	......	......	......	......	......
Sheepshead	3,000	180	......	......	480	29	......	......	......	......
Trout	2,800	168	......	......	1,500	90	......	......	......	......
Other fish	4,000	240	......	......	4,000	220	......	......	......	......
Crabs	......	......	......	......	12,000	370	......	......	6,320	252
Total	21,600	1,176	......	......	46,910	1,799	......	......	6,320	252
Spears:										
Flounders	27,500	1,615	......	......	......	......	......	......	48,000	1,824
Tongs and rakes:										
Oysters	592,340	26,142	29,400	1,260	225,148	8,355	168,420	5,980	397,110	13,640
Grand total	1,547,195	74,493	144,370	7,897	315,658	12,530	195,620	7,073	1,297,270	39,861

SUMMARY.

Apparatus and species.	Lbs.	Value.
Seines:		
Blue-fish	22,450	$970
Buffalo-fish	12,200	470
Cat-fish	6,400	286
Channel bass or red-fish	831,367	38,280
Crevalle	16,000	655
Croakers	103,450	4,642
Drum	37,150	1,518
Flounders	79,625	3,754
Hog-fish	12,700	620
Jew-fish	1,000	42
Mullet, fresh	33,800	1,236
Mullet, salted	500	25
Perch	20,400	964
Pike	15,650	713
Pompano	11,600	544
Sheepshead	342,950	16,210
Spanish mackerel	28,800	1,379
Striped bass	6,000	260
Sturgeon	22,400	984
Trout	729,620	33,472
Other fish	51,000	2,100
Shrimp	291,560	6,090
Turtles	49,600	1,730
Terrapins	3,730	440
Total	2,729,952	117,384

Apparatus and species.	Lbs.	Value.
Cast nets:		
Croakers	2,000	$60
Mullet	21,600	747
Perch	3,900	204
Trout	11,300	512
Shrimp	60,600	1,106
Total	99,400	2,629
Turtle nets:		
Turtles	159,120	3,997
Minor nets:		
Crabs	112,000	2,800
Lines:		
Cat-fish	64,830	2,749
Channel bass or red-fish	14,700	710
Jew-fish	13,800	588
Sheepshead	3,480	209
Trout	5,800	313
Other fish	8,000	460
Crabs	26,120	889
Total	136,730	5,918
Spears:		
Flounders	110,900	4,855
Tongs and rakes:		
Oysters	1,877,498	71,754
Grand total	5,225,600	209,337

The extent of the wholesale trade in fishery products on the Texas coast is set forth in the following summary. Most of the products of Matagorda, Aransas, and Corpus Christi bays are shipped respectively from Port Lavaca, Rockport, and Corpus Christi to the west and southwest, and the same is true of the red snappers caught off Galveston. But most of the products of other sections of the coast are consumed in the localities where obtained. A noticeable feature of the wholesale fish trade on this coast is the organization effected by the fishermen several years ago of union or cooperative fish markets, the profits of which are shared in by the fishermen. But at present these are not patronized by the fishermen as generally as three or four years ago. There is no drying, pickling, smoking, or canning of fishery products along the Texas coast.

Statement showing the extent of the wholesale trade in fishery products for Texas in 1897.

Items.	Corpus Christi.		Galveston.		Port Lavaca.		Rockport.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Establishments	2	$12, 100	1	$3, 300	2	$10,800	2	$6, 500	7	$32. 700
Cash capital		6, 000		2, 000		13,000		9, 000		30, 000
Tons of ice used	200	1, 600	120	480	180	1,120	200	1, 400	700	4, 600
Employees	14		4		17		7		42	
Products handled.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds	Value.	Pounds.	Value.
Blue-fish	6, 400	$386			7, 100	$465	9, 000	$560	22, 500	$1, 411
Cat-fish							11, 000	715	11, 000	715
Channel bass or red-fish	229, 324	13, 182			232, 180	16, 074	228, 642	13, 816	690, 146	43, 072
Crevalle	3, 000	160			2, 000	130	2, 800	146	7, 800	436
Croakers	21, 854	1, 270			21, 650	1, 287	7, 520	457	51, 024	3, 014
Flounders	38, 730	2, 297			24, 120	1, 405	47, 654	3, 071	110, 504	6, 773
Hog-fish	3, 000	180			4, 340	312	2, 400	165	9, 740	657
Jew-fish							12, 000	815	12, 000	815
Perch	4, 200	242			7, 634	513	3, 200	187	15, 034	942
Pike	9, 850	583					800	48	10, 650	631
Pompano	4, 250	283			5, 000	400	6, 720	584	15, 970	1, 267
Mullet	8, 000	410			2, 600	152	22, 150	1, 276	32, 750	1, 838
Red snapper			464, 791	$23, 380					464, 791	23, 380
Sheepshead	103, 450	6, 454			84, 500	5, 792	74, 500	4, 815	262, 450	17, 061
Spanish mackerel	10, 540	735			8, 120	632	9, 000	644	27, 660	2, 011
Striped bass	2, 000	120					2, 000	140	4, 000	260
Trout	296, 000	16, 695			151, 545	9, 023	188, 850	11, 698	636, 395	37, 416
Other fish	32, 000	1, 920	19, 143	628			12, 400	693	63, 543	3, 241
Turtles	80, 620	2, 816			44, 615	2, 685	28, 000	1, 360	153, 235	6, 861
Terrapins							950	295	950	295
Shrimp	204, 150	5, 634			9, 000	360	3, 000	140	216, 150	6, 134
Oysters	410, 480	22, 870			602, 084	30, 152	217, 000	9, 765	[1]1,229,564	62, 787
Total	1,467,848	76, 237	483, 934	24, 008	1,206,488	69, 382	889, 586	51, 390	4,047,856	221, 017

[1] 175,652 bushels.

STATISTICS

OF THE

FISHERIES OF THE SOUTH ATLANTIC STATES.

PREPARED IN THE DIVISION OF STATISTICS AND METHODS OF THE FISHERIES, UNITED STATES FISH COMMISSION.

C. H. TOWNSEND, Assistant in Charge.

INTRODUCTORY NOTE.

The accompanying statistical report on the fisheries of the South Atlantic States is based on investigations made by agents of the United States Fish Commission in 1898, the information relating to the year 1897. The general results of this work were made public in the report of the Division of Fisheries for 1898, and were also presented earlier and in more condensed form in Statistical Bulletin No. 9. Single sheet statistical bulletins are usually issued upon the completion of field work, and distributed in the fishery region to which they refer, in advance of the regular reports of the Commission. The information collected during this canvass is here presented in full, the results having been tabulated and the various features of the fisheries shown in detail.

The report has been prepared under the direction of Mr. C. H. Townsend, assistant in charge of the Division of Fisheries. The field inquiries were conducted by Messrs. W. A. Wilcox, T. M. Cogswell, and John N. Cobb, agents of the division, to whom should be credited the explanatory notes relating to the States in which they worked. The fisheries of North Carolina were canvassed by Messrs. Cogswell and Cobb; those of South Carolina and Georgia by Mr. Wilcox, and of eastern Florida by Mr. Cobb.

The assistant in charge has had the constant aid of Mr. S. Le R. Pritchard and other members of the office force of the division in the preparation of the tables.

GEO. M. BOWERS,
Commissioner.

STATISTICS OF THE FISHERIES OF THE SOUTH ATLANTIC STATES.

GENERAL NOTES AND STATISTICS.

The condition of the commercial fisheries of this region, as shown in the following report, has not changed to any marked degree since they were canvassed in 1890. Although there has been a general increase in respect to persons employed, capital invested, and value of products, the development of the fisheries is not yet proportionate to the important fishery resources of the States considered. The region, as a whole, with its numerous rivers and extensive sounds, is destined to maintain greater fishery industries.

The investigations were confined to the coastal waters and to the lower courses of the rivers as far inland as commercial fisheries are maintained.

The table on pp. 176–177 gives general comparisons with former canvasses made in 1880 and 1890. Comparisons in detail may be made by consulting previous statistical publications* of the United States Fish Commission on this subject.

The tables on pp. 174–175 show, by States, the condition of the fisheries of the South Atlantic States in 1897. The capital invested in the fisheries of this region amounted to $1,828,832. Of this amount $1,218,459 is credited to North Carolina, $174,354 to South Carolina, $284,864 to Georgia, and $151,155 to eastern Florida.

The total number of persons employed was 17,185, of which number 14,449 were fishermen and 2,736 shoresmen. In the North Carolina fisheries alone 12,045 were employed; in South Carolina, 2,139; and in Georgia, 1,869. The fishermen of the eastern coast of Florida numbered 1,132.

The total number of vessels employed was 243, having a tonnage of 2,790.83, and valued, with their outfit, at $200,280. The total number of boats in this region was 6,691, valued at $276,866. The apparatus of capture had a value of $492,596, and other accessory property $531,290.

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*The Fishery Industries of the United States, section II, Geographical Review of the Fisheries for 1880.

The Fishery Industries of the United States, section V, History and Methods of the Fisheries.

Report on the Fisheries of the South Atlantic States, by Hugh M. Smith, M. D. Bull. U. S. Fish Com., 1891, pp. 267–356.

The Fish and Fisheries of the Coastal Waters of Florida. U. S. Fish Commission Report for 1896, pp. 263–342.

Report on the Fisheries of Indian River, Florida. U. S. Fish Commission Report for 1896, pp. 223–262.

Notes on the Extent and Condition of the Alewife Fisheries of the United States in 1896, by Hugh M. Smith. Report U. S. Fish Commission for 1898, pp. 31–43.

The Shad Fisheries of the Atlantic Coast of the United States, by Charles H. Stevenson. Report U. S. Fish Commission, 1898, pp. 101–269.

Gill nets have been the most important form of apparatus employed, and were valued at $243,482, pound nets ranking next in importance, with a value of $137,175. The value of seines is placed at $95,340, all other forms of apparatus being of minor importance.

The products of the fisheries amount to 80,390,465 pounds, with a value of $1,833,155. The products of the fisheries of North Carolina were valued at $1,316,017; those of South Carolina, $210,456; of Georgia, $170,605; and of eastern Florida, $136,077. The most important item with respect to product is shad, which is valued at $478,784, oysters ranking next, with a value of $384,934. Mullet is third and is valued at $115,465. Alewives and squeteague follow with values of $118,124 and $112,578, respectively.

Shad and oysters are by far the most important products of the fisheries of North Carolina; oysters, whiting, shad, and sea bass of South Carolina and Georgia, while in eastern Florida the leading fishery products are shad, mullet, pompano, and squeteague.

Since the last canvass of this region, which was in 1890, there has been an increase in the fisheries of all these States except eastern Florida. Taking the region as a whole, there has been an increase in products of 13,205,847 pounds, having a value of $259,451. There has been an increase in capital invested of $140,546. North Carolina is the only State where the investment has decreased, the amount of this decrease being $25,529. Since 1890 the value of the yield of the more important fishes, such as shad, mullet, and alewives, has been nearly stationary, while that of oysters has increased about one-third.

Table showing the number and value of vessels, boats, apparatus, and shore property employed in the fisheries of the South Atlantic States in 1897.

Items.	North Carolina.		South Carolina.		Georgia.		Florida.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels	174	$151,375	16	$15,742	51	$28,833	2	$4,330	243	$200,280
Tonnage	1,879.23	....	252.93	....	641.80	....	16.87	....	2,790.83	....
Boats	4,428	202,709	1,056	34,080	680	20,277	527	19,800	6,691	276,866
Seines	1,044	86,165	88	3,045	66	2,395	44	3,735	1,242	95,340
Gill nets	86,688	179,190	408	23,840	424	11,905	487	28,547	88,007	243,482
Pound nets	1,852	136,375	....	....	4	800	....	....	1,856	137,175
Fyke nets	23	341	....	....	....	....	....	....	23	341
Cast nets	(*)	....	123	615	82	385	30	165	235	1,165
Turtle nets	....	....	....	....	....	....	37	380	37	380
Pots	1,233	885	....	....	....	....	....	....	1,233	885
Lines	....	247	....	1,425	....	205	....	46	....	1,923
Wheels	70	1,050	....	....	....	....	....	....	70	1,050
Dredges	26	855	....	....	5	50	....	....	31	905
Tongs, rakes, and grabs	1,491	3,383	246	1,692	547	2,133	51	337	2,335	7,545
Other apparatus	....	2,320	....	60	....	25	....	....	....	2,4 5
Shore and accessory property	....	315,164	....	45,055	....	106,356	....	64,715	....	531,290
Cash capital	....	138,400	....	48,800	....	111,500	....	29,100	....	327,800
Total	....	1,218,459	....	174,354	....	284,864	....	151,155	....	1,828,832

* Shown in other apparatus.

Number of persons employed in the fisheries of the South Atlantic States in 1897.

States.	Fishermen.	Shoresmen.	Total.
North Carolina	10, 120	1, 925	12, 045
South Carolina	1, 934	205	2, 139
Georgia	1, 404	465	1, 869
Florida	991	141	1, 132
Total	14, 449	2, 736	17, 185

Table showing the quantity and value of products taken in the fisheries of the South Atlantic States in 1897.

Species.	North Carolina.		South Carolina.		Georgia.		Florida.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives, fresh	5, 694, 201	$48, 756	2, 000	$40	25, 000	$500	33, 913	$404
Alewives, salted	10, 096, 236	78, 299	....	....	....	....	5, 000	125
Black bass	535, 342	23, 611	1, 000	30	4, 600	322	52, 516	2, 184
Blue-fish, fresh	1, 482, 375	41, 608	40, 000	1, 600	....	....	46, 421	1, 121
Blue-fish, salted	213, 800	5, 144	....	....	....	....	....	....
Bonito	2, 350	35	....	....	....	....	....	....
Butter-fish	94, 750	1, 758	....	....	....	....	....	....
Cat-fish	192, 211	4, 646	28, 500	535	157, 600	2, 734	124, 000	3, 720
Channel bass or red-fish, fresh	64, 550	830	110, 000	2, 500	23, 800	1, 190	235, 782	3, 542
Channel bass or red-fish, salted	40, 200	804	....	....	....	....	....	....
Drum	51, 400	1, 073	215, 000	1, 875	14, 300	592	17, 000	175
Eels	96, 700	4, 051	....	....	5, 000	100	....	....
Flounders	173, 975	3, 199	....	....	6, 500	290	....	....
Groupers	....	....	33, 000	1, 170	....	....	....	....
Hickory shad	230, 975	7, 583	36, 800	1, 516	7, 775	262	....	....
King-fish	358, 070	7, 628	....	....	....	....	....	....
Menhaden	11, 310, 000	19, 700	....	....	....	....	....	....
Mullet, fresh	797, 425	16, 797	46, 000	885	56, 000	1, 310	2, 341, 957	21, 156
Mullet, salted	2, 612, 160	73, 541	10, 000	200	....	....	71, 400	1, 576
Perch	806, 379	24, 044	2, 000	40	3, 600	140	....	....
Pig-fish	412, 807	10, 285	....	....	....	....	....	....
Pike	100, 420	2, 655	....	....	....	....	....	....
Pin-fish	61, 600	1, 064	....	....	....	....	....	....
Pompano	53, 175	1, 728	5, 000	300	....	....	196, 344	13, 093
Porgy	39, 910	472	....	....	....	....	....	....
Sailor's choice	39, 000	975	8, 800	440	600	30	....	....
Scad or round robin	8, 100	46	....	....	....	....	....	....
Sea bass	189, 225	5, 564	632, 400	26, 356	....	....	5, 570	210
Shad	8, 963, 488	362, 811	506, 125	27, 696	787, 550	46, 705	1, 011, 180	41, 572
Sharks	....	....	30, 000	300	....	....	....	....
Sheepshead	271, 206	9, 243	36, 200	1, 460	25, 000	1, 250	390, 164	5, 908
Snappers	34, 400	860	54, 000	1, 660	....	....	....	....
Spanish mackerel	330, 840	18, 017	10, 000	1, 000	18, 100	655	3, 450	160
Spots and croakers, fresh	1, 963, 756	28, 384	49, 000	730	....	....	23, 133	772
Spots and croakers, salted	165, 246	4, 749	....	....	....	....	....	....
Squeteague, fresh	3, 006, 758	92, 993	80, 000	2, 030	54, 650	2, 512	516, 370	12, 817
Squeteague, salted	83, 496	2, 226	....	....	....	....	....	....
Strawberry bass	21, 725	866	....	....	....	....	....	....
Striped bass	845, 123	58, 035	10, 100	556	9, 000	530	....	....
Sturgeon	371, 625	13, 525	411, 100	7, 325	147, 700	4, 060	....	....
Suckers	135, 230	3, 037	....	....	....	....	....	....
Sun-fish	38, 210	1, 000	....	....	3, 900	195	248, 989	6, 827
Tautog	14, 125	283	....	....	....	....	....	....
Warmouth bass	6, 950	348	....	....	....	....	....	....
Whiting	45, 300	1, 133	638, 500	28, 405	45, 700	2, 100	8, 000	365
Other fish	....	....	....	....	....	....	103, 340	3, 356
Shrimp	146, 496	5, 885	374, 500	18, 395	67, 600	2, 535	38, 625	1, 497
Crabs, soft	986, 720	3, 992	....	....	....	....	....	....
Crabs, hard	40, 000	1, 000	110, 000	2, 240	74, 660	1, 864	3, 700	175
Craw-fish	....	....	....	....	....	....	4, 000	80
Terrapins	17, 179	2, 815	40, 916	9, 635	34, 785	11, 254	10, 350	1, 425
Turtles	24, 000	1, 920	....	....	1, 000	20	23, 856	1, 751
Frogs	1, 800	450	....	....	....	....	....	....
Oysters	6, 011, 726	241, 099	1, 504, 300	45, 360	3, 406, 440	86, 709	362, 802	11, 766
Clams	937, 808	53, 703	185, 400	8, 652	2, 640	165	4, 800	300
Scallops	118, 323	5, 653	....	....	....	....	....	....
Caviar	32, 500	11, 162	69, 805	17, 525	9, 600	2, 581	....	....
Squeteague sounds	691	104	....	....	....	....	....	....
Refuse	3, 862, 200	4, 828	....	....	....	....	....	....
Total	64, 234, 257	1, 316, 017	5, 280, 446	210, 456	4, 993, 100	170, 605	5, 882, 662	136, 077

Table showing the quantity and value of products taken in the fisheries of the South Atlantic States in 1897—Continued.

SUMMARY.

Species.	Lbs.	Value.	Species.	Lbs.	Value.
Alewives, fresh	5, 755, 114	$49, 700	Sheepshead	722, 570	$17, 861
Alewives, salted	10, 101, 236	78, 424	Snappers	88, 400	2, 520
Black bass	593, 458	26, 147	Spanish mackerel	362, 390	19, 832
Blue-fish, fresh	1, 568, 796	44, 329	Spots and croakers, fresh	2, 035, 889	29, 886
Blue-fish, salted	213, 800	5, 144	Spots and croakers, salted	165, 246	4, 749
Bonito	2, 350	35	Squeteague, fresh	3, 657, 778	110, 352
Butter-fish	94, 750	1, 758	Squeteague, salted	83, 496	2, 226
Catfish	502, 311	11, 635	Strawberry bass	21, 725	866
Channel bass or red-fish, fresh	434, 132	8, 062	Striped bass	864, 223	59, 121
Channel bass or red-fish, salted	40, 200	804	Sturgeon	930, 425	24, 910
Drum	297, 700	3, 715	Suckers	135, 230	3, 037
Eels	101, 700	4, 151	Sun-fish	291, 099	8, 022
Flounders	180, 475	3, 489	Tautog	14, 125	283
Groupers	33, 000	1, 170	Warmouth bass	6, 950	348
Hickory shad	275, 550	9, 361	Whiting	737, 500	32, 003
King-fish	358, 070	7, 628	Other fish	103, 340	3, 356
Menhaden	11, 310, 000	19, 700	Shrimp	627, 221	28, 312
Mullet, fresh	3, 241, 382	40, 148	Crabs, soft	986, 720	3, 992
Mullet, salted	2, 693, 560	75, 317	Crabs, hard	228, 360	5, 279
Perch	811, 979	24, 224	Craw-fish	4, 000	80
Pig-fish	412, 807	10, 285	Terrapins	103, 230	25, 129
Pike	100, 420	2, 655	Turtles	48, 856	3, 691
Pin-fish	61, 600	1, 064	Frogs	1, 800	450
Pompano	254, 519	15, 121	Oysters	11, 285, 268	384, 934
Porgy	39, 910	472	Clams	1, 130, 648	62, 820
Sailor's choice	48, 400	1, 445	Scallops	118, 323	5, 653
Scad or round robin	8, 100	46	Caviar	111, 905	31, 268
Sea bass	827, 195	32, 130	Squeteague sounds	691	104
Shad	11, 268, 343	478, 784	Refuse	3, 862, 200	4, 828
Sharks	30, 000	300	Total	80, 390, 465	1, 833, 155

Comparative table showing the extent of the fisheries of the South Atlantic States in 1880, 1890, and 1897.

PERSONS ENGAGED.

States.	1880.	1890.	1897.	Increase or decrease in 1897 compared with 1890.	Percentage of increase or decrease in 1897 compared with 1890.
North Carolina	5, 274	10, 274	12, 045	+1, 771	+17. 23
South Carolina	1, 005	2, 701	2, 139	— 562	—20. 81
Georgia	899	1, 622	1, 869	+ 247	+15. 23
Florida	368	1, 404	1, 132	— 272	—19. 37
Total	7, 546	16, 001	17, 185	+1, 184	+ 7. 40

CAPITAL INVESTED.

States.	1880.	1890.	1897.	Increase or decrease in 1897 compared with 1890.	Percentage of increase or decrease in 1897 compared with 1890.
North Carolina	$506, 561	$1, 243, 988	$1, 218, 459	— 25, 529	— 2. 05
South Carolina	66, 275	127, 762	174, 354	+ 46, 592	+36. 47
Georgia	78, 770	174, 431	284, 864	+110, 433	+63. 31
Florida	43, 554	142, 105	151, 155	+ 9, 050	+ 6. 37
Total	695, 160	1, 688, 286	1, 828, 832	+140, 546	+ 8. 32

Comparative table showing the extent of the fisheries of the South Atlantic States in 1880, 1890, and 1897—Continued.

PRODUCTS.

States.	Pounds.				Percentage of increase or decrease in 1897 compared with 1890.
	1880.	1890.	1897.	Increase or decrease in 1897 compared with 1890.	
North Carolina	32, 249, 488	51, 799, 142	64, 234, 257	+12. 435, 115	+24. 01
South Carolina	6, 143, 250	4, 932, 703	5, 280, 446	+ 347, 743	+ 7. 05
Georgia	2, 272, 500	2, 991, 117	4, 993, 100	+ 2, 001, 983	+66. 93
Florida	2, 286, 750	7, 461, 656	5, 882, 662	— 1, 578, 994	—21. 16
Total	42, 951, 988	67, 184, 618	80, 390, 465	+13, 205, 847	+19. 65

States.	Value.				
	1880.	1890.	1897.	Increase or decrease in 1897 compared with 1890.	Percentage of increase or decrease in 1897 compared with 1890.
North Carolina	$845, 695	$1, 027, 669	$1, 316, 017	+288, 348	+28. 06
South Carolina	212, 482	202, 602	210, 456	+ 7, 854	+ 3. 88
Georgia	119, 993	123, 563	170, 605	+ 47, 042	+38. 07
Florida	78, 408	219, 870	136, 077	— 83, 793	—38. 11
Total	1, 256, 578	1, 573, 704	1, 833, 155	+259, 451	+16. 49

FISHERIES OF NORTH CAROLINA.

The fisheries of North Carolina have continued to increase in nearly all respects and are now of greater importance than ever before. In the number of persons employed and value of products they are more than twice as important as those of all the other South Atlantic States combined and nearly equal them in point of capital invested. The prominent position of the fishing industry in this State is due chiefly to the vast extent of its sounds and other coastal bodies of water, fresh and salt. Several rivers have fisheries on their lower courses, and the ocean banks are fished extensively. The industry as a whole is of greater value than any other branch of trade in the eastern part of the State.

The three tables on p. 178 show the extent of the fisheries in 1897.

The total number of persons employed was 12,045.

The capital invested amounted to $1,218,459. The value of vessels and their outfits was $151,375; of boats, steam flats, and pile-drivers, $202,709; of apparatus of capture, $410,811; of shore property and working capital, $453,564.

The yield amounted to 64,234,257 pounds of fishery products with a value of $1,316,017, an increase of over 12,000,000 pounds since 1890. Shad continues to be the most important species in the North Carolina fisheries, the value of which was $362,811. The yield of this species shows an increase in weight of 3,195,075 pounds, and in value of $56,796. The next species in importance, the oyster, had a value of $241,099, an advance of $65,532 since 1890. Alewives had a value of $127,055, after which the more important species were squeteague, worth $95,219; mullet, worth $90,338; striped bass, worth $58,035; blue-fish, worth $46,752, and clams, worth $53,703, an increase of over $40,000 since 1890.

Persons employed.

How engaged.	No.
On vessels fishing	455
On vessels transporting	188
In shore or boat fisheries	9,463
On boats transporting	14
Shoresmen	1,925
Total	12,045

Table of apparatus and capital.

Items.	No.	Value.	Items.	No.	Value.
Vessels fishing	98	$69,450	Apparatus—shore fisheries:		
Tonnage	1,017.20		Seines	1,026	$79,465
Outfit		21,327	Gill nets	86,639	177,820
Vessels transporting	76	53,175	Pound nets	1,852	136,375
Tonnage	862.03		Fyke nets	23	341
Outfit		7,423	Minor nets	775	1,867
Boats fishing	4,420	200,251	Lines		247
Boats transporting	8	2,458	Pots	1,233	885
Apparatus—vessel fisheries:			Wheels	70	1,050
Seines	18	6,700	Tongs and rakes	1,352	3,023
Gill nets	49	1,370	Miscellaneous		453
Dredges	26	855	Shore and accessory property		315,164
Tongs	139	360	Cash capital		138,400
			Total		1,218,459

Table of products.

Species.	Lbs.	Value.	Species	Lbs.	Value.
Alewives, fresh	5,694,201	$48,756	Sheepshead	271,206	$9,243
Alewives, salted	10,096,236	78,299	Snappers	34,400	860
Black bass	535,342	23,611	Spanish mackerel	330,840	18,017
Blue-fish, fresh	1,482,375	41,608	Spots, fresh	716,137	9,870
Blue-fish, salted	213,800	5,144	Spots, salted	133,846	4,327
Bonito	2,350	35	Squeteague, fresh	3,006,758	92,993
Butter-fish	94,750	1,758	Squeteague, salted	83,496	2,226
Cat-fish	192,211	4,646	Strawberry bass	21,725	866
Channel bass, fresh	64,550	830	Striped bass	845,123	58,035
Channel bass, salted	40,200	804	Sturgeon	371,625	13,525
Croakers, fresh	1,247,619	18,514	Suckers	135,230	3,037
Croakers, salted	31,400	422	Sun-fish	38,210	1,000
Drum	51,400	1,073	Tautog	14,125	283
Eels	96,700	4,051	Warmouth bass	6,950	348
Flounders	173,975	3,199	Whiting	45,300	1,133
Hickory shad	230,975	7,583	Shrimp	146,496	5,885
King-fish	358,070	7,628	Crabs, soft	[1] 986,720	3,992
Menhaden	11,310,000	19,700	Crabs, hard	[2] 40,000	1,000
Mullet, fresh	797,425	16,797	Terrapins	[3] 17,179	2,815
Mullet, salted	2,612,160	73,541	Turtles	[4] 24,000	1,920
Perch	806,379	24,044	Frogs	[5] 1,800	450
Pig-fish	412,807	10,285	Oysters	[6] 6,011,726	241,099
Pike	100,420	2,655	Clams	[7] 937,808	53,703
Pin-fish	61,600	1,064	Scallops	[8] 118,323	5,653
Pompano	53,175	1,728	Caviar	32,500	11,162
Porgy	39,910	472	Squeteague sounds	691	104
Sailor's choice	39,000	975	Refuse	3,862,200	4,828
Scad or round robin	8,100	46			
Sea bass	189,225	5,564	Total	64,234,257	1,316,017
Shad	8,963,488	362,811			

[1] Represents 2,960,160 in number.
[2] Represents 120,000 in number.
[3] Represents 8,160 in number.
[4] Represents 320 in number.
[5] Represents 3,600 in number.
[6] Represents 858,818 bushels.
[7] Represents 117,226 bushels.
[8] Represents 26,294 bushels.

THE FISHERIES BY COUNTIES.

Twenty-six counties are represented in the commercial fisheries of North Carolina. Of this number 17 have a frontage on the ocean or on the sounds tributary thereto, and many of them maintain important fisheries. Those bordering the sounds and the ocean are Currituck, Camden, Pasquotank, Perquimans, Chowan, Bertie, Washington, Tyrrell, Dare, Hyde, Pamlico, Craven, Carteret, Onslow, Pender, New Hanover, and Brunswick.

In the tables beginning on page 184 the fisheries of each of these counties are shown in detail.

In the number of persons employed and in the amount of capital invested Carteret takes precedence over all other counties in the State, occupying the position formerly held by Dare County, the latter taking second place in this regard, though still holding first place in value of products.

A large proportion of the fish caught in Carteret County are handled by wholesale dealers at Beaufort and Morehead City. These firms handled in 1897 1,756,868 pounds, having a gross value of $70,274. In addition to fish the same firms handled shucked oysters, scallops, and clams.

A comparatively new industry in Carteret County since the former investigation is that of shipping soft-shell crabs to the Northern markets, the total number shipped in 1897 being 13,600 dozen. This business is growing steadily, and at Marshallberg one firm has an extensive plant where crabs are kept in floats preparatory to their shedding and becoming marketable.

Nearly all the oysters handled by the dealers in Carteret County are bought opened, the oystermen receiving an average of 35 cents per gallon for them. The scallops are all bought in this way, none being sold in the shell, the price for the same ranging from 40 to 45 cents per gallon.

In this county the seine fishery has undergone some changes in recent years, a law having been enacted prohibiting the hauling of any seine over 200 yards in length. Such seines are generally used in the mullet fishery. There are many "drag nets," so called, or small seines, with a length of about 350 feet each. These nets are fished in the sounds and also on the outside along the banks. The total number of nets of this class in use in Carteret County in 1897 was 329. In the fisheries of this county 5,250 stake gill nets were used; 25 large stake nets, with an average length of 200 yards each, were fished along the banks. The fishing of large stake nets of this character is of comparatively recent date. 225 small boats with 375 men engaged in tonging oysters in Carteret County, their catch in the aggregate amounting to 244,800 bushels, with a value to the fishermen of $60,299.

In the catching of scallops and clams about 150 persons are engaged. The scallops are caught with scoops and drags. The scoops have a long wooden handle with a hoop and net attached. The drags are thrown out from the stern of the boat and hauled aft as the boat proceeds. Two drags are usually carried by each boat. The fishermen open the scallops before selling them to the dealers. The amount opened was 13,147 gallons, worth $5,653.

In clamming, rakes are used to some extent, the greater portion of the clams being picked by hand from the bars at low tide. Many women and children engage in this work. In the deeper water what is known as "treading for clams" is practiced to some extent. This consists of wading around and feeling for the clams with bare feet. When a clam is located the fisherman reaches down in the water and brings it to the surface.

Forty-seven vessels from Carteret County are engaged in tonging oysters, and 12 vessels in dredging oysters. The dredged oysters all come from Pamlico Sound, as dredging is prohibited in the waters of Carteret County. The catch of vessels tonging oysters amounted to 52,625 bushels, valued at $13,054. The vessels dredging caught 63,900 bushels, valued at $15,975. Eleven vessels were engaged in fishing for menhaden. The porpoise fishery formerly prosecuted in this county has been abandoned, owing to the diminished inducements offered to engage in the same.

The absence of shad in the species table for Carteret County is to be accounted for by the removal of pound nets owned by Carteret County fishermen into the waters of Craven County, their catch being credited to this county. This was formerly the principal apparatus for taking shad in the waters of Carteret.

In Onslow County a form of gill net known as a "drop net" is used extensively in the fisheries. They number 655, and the catch was 668,175 pounds, valued at $21,833. This county is noted for its mullet fishery, and the trade name "New River mullet" is well known throughout the State. Ten seines were employed in the mullet fishery, being fished in the ocean and at the mouths of the inlets along the coastal line of the county. Though these nets are used primarily for mullet, a few other fish are taken incidentally. The catch of mullet aggregated 750,000 pounds, valued at $22,168. The oyster fishery has increased, and in the value of the output takes second place in the oyster industry of North Carolina. The increase is chiefly owing to the better facilities for marketing the catch. New River oysters are much in favor, and find a ready market in the Northern cities and the interior towns and cities of the State. A fine grade of barrel stock is taken from the private beds, which sells readily in the larger cities at $4.50 per barrel. The catch of oysters amounted to 120,000 bushels, valued at $60,000, an average of 50 cents per bushel. The increase over 1890 was 71,500 bushels, with a value of $42,400.

The fisheries of Pender County are prosecuted in Topsail and Middle sounds, Cape Fear River, and in Northeast River, a branch of the Cape Fear. In the sounds haul seines and drop gill nets are used, the catch consisting of salt-water varieties. On the rivers mentioned skim nets, drift gill nets, and small seines are used, taking shad, alewives, and other species.

In Duplin County fishing is carried on in the Northeast River by means of gill nets and haul seines.

The fisheries of Sampson County give employment to 190 persons during the fishing season, who, as a rule, reside near the Black River and its tributaries. Skim nets, drift gill nets, and haul seines are the forms of apparatus in general use.

The only important stream in Bladen County is the Cape Fear River, whose fisheries gave employment to 156 persons during the fishing season. The apparatus in use consists of skim nets and drift gill nets used in the taking of shad.

In New Hanover County fishing is carried on in the inlets and the ocean. From Topsail Inlet to Hewletts Creek 21 small seines are fished in the sounds, the catch consisting of mullet and other varieties of salt-water fish. At Ocean View 4 seines, whose principal catch is mullet, are fished at the following-named points: One at Ocean View Beach in the ocean and three at Masonboro Inlet. Seines are also used at Queens and Rich Inlets and in the ocean, taking mullet and other species of fish. Near Masonboro Inlet 10 shrimp seines are operated, their catch amounting to 3,600 bushels of shrimp, valued at $5,760. A fishery for sturgeon on the Cape Fear River employed 50 men using 25 drift nets. The catch of sturgeon numbered 625, with a weight of 93,750 pounds, and a value of $2,812. From the roe of these sturgeon 89 kegs of caviar were manufactured, valued at $4,539.

One hundred and one drift gill nets for shad were employed in the river above and below the city of Wilmington, the catch aggregating 236,781 pounds, with a value of $13,706. In point of value the shad surpasses all other fishery products in New Hanover County with the exception of the oyster. In Myrtle Grove Sound and its tributary creeks oysters are taken in considerable quantities by hand-picking and tonging. They are sold opened, retailing at 50 cents per gallon. The catch consisted of 64,000 bushels, or 56,000 gallons opened, valued at $28,000. In addition to the oysters 18,000 bushels of clams were taken.

Fishing with hook and line in the ocean is largely followed, the boats resorting to the vicinity of the submerged rocks that fringe the coast, and the fishery is locally known as "rock fishing." Large quantities of choice salt-water varieties are taken, finding a ready market. There is also a summer fishery with lines in Cape Fear River. The total line catch amounted to 529,040 pounds, with a value of $17,209.

In Brunswick County 14 large seines are operated, principally in the ocean. Ten small seines, averaging about 250 feet, are fished in the inlets, taking mullet chiefly. Drop gill nets are employed at Southport and vicinity for croakers, spots, etc. A small number of terrapin and turtle seines are in use. The seines average 100 yards, with a depth of

18 to 20 feet. The catch of diamond-back terrapin numbered 1,800, valued at $630, and 320 green turtles were taken valued at $1,920.

The clam industry has grown considerably in Brunswick County in the past five or six years, and now employs a large number of persons. The men engaged camp on the beach during most of the week. The season for clamming is regulated by law and begins November 15 and closes April 15. The catch for 1897 amounted to 50,000 bushels, valued at $22,500. The clamming grounds are along the inlets that border the county.

The fishing centers of Hyde County are in the vicinity of Mount Pleasant, Middletown, and Engelhard. As a whole, the fisheries of this county show a large increase in the amount of shad taken and also an increase of 140,000 bushels in the oyster output. The total quantity of oysters was 216,890 bushels, with a value of $43,378. In addition to the market oysters tonged, 21,210 bushels of seed oysters, with a value of $2,205, were sold. The greater portion of the oysters are sold to vessels that come from other States and anchor on the fishing-grounds, buying the tonged oysters from the small boats engaged in the business.

The shad fisheries of Hyde County show an increase of 183,820 pounds over the figures for 1890. The total for 1897 was 252,000 pounds, as against 68,180 pounds in 1890. Most of the shad credited to Hyde County are taken in the adjoining county of Dare, where the fishermen camp during the shad season.

In point of capital invested Beaufort County ranks fifth, and maintains important fisheries on the Pamlico and Pungo rivers. The wholesale trade is centered at Washington. The principal apparatus in use is seines, 49 being employed, their catch amounting to 563,103 pounds, valued at $16,772, more than one-half of the catch of the county. Next to the seine in importance is the pound net, the catch from the latter amounting to 377,715 pounds, valued at $8,315. At Belhaven two oyster establishments are located, both engaged in shucking oysters for shipment, the output aggregating about 10,500 gallons, marketed in the Northern cities.

Craven County occupies a prominent position in the fisheries. The bulk of the catch on Neuse River is handled at Newbern; the quantity is estimated at 1,565,000 pounds, with an aggregate value of $60,600, and 50,754 gallons of oysters were shipped to Northern cities and as far west as Chicago. More than two-thirds of the output of Craven County was captured with seines. Formerly pound nets were fished to a great extent in Neuse River, many fishermen coming from other localities to engage in this fishery. As a result the nets increased in such numbers that a law, becoming operative in July, 1897, has been passed prohibiting their use in the river.

The fisheries of Pamlico County are not very extensive, though a decided improvement is shown. They are carried on mainly in the

Neuse River. At Bay River an oyster fishery has recently been established, which grows steadily in importance, the oysters being taken in the river and around Brant Island, in Pamlico Sound. Fifty small boats were engaged, the catch amounting to 36,000 bushels, with a value to the oystermen of $9,000.

While Dare County is second in number of persons employed, it maintains first place in the value of products. This is due to the great value of the shad fisheries. In addition to the shore fisheries a vessel fishery is maintained, with 15 vessels. Three or four engage in taking striped bass; the remainder devote their time to the oyster fisheries. The remoteness of the fishing-grounds necessitates the employment of 24 vessels to carry the catch to market. The catch of blue-fish in this county was 780,890 pounds, valued at $28,822.

Chowan County is third in importance of its fisheries, the output amounting to 12,292,720 pounds, with a value of $112,787. The capital invested was $136,048. Of this amount $40,365 was employed in the pound-net fishery, representing 622 nets. This method of fishing has increased year by year and is the mainstay of the fisheries of this county. The pound-net catch amounted to 6,989,598 pounds, with a value of $69,275, more than one-half of the entire catch of the county being taken in this form of apparatus. Alewives are the leading species taken, amounting to 6,147,384 pounds, valued at $40,049; shad ranking second with 675,680 pounds, valued at $21,538.

The fisheries of Currituck County show a large increase, amounting to 688,549 pounds over 1890, with an advance in value of nearly $10,000. This increase is largely in the seine fisheries, over 1,000,000 pounds being taken with this apparatus. The most important species is the black bass, amounting to 490,280 pounds, and valued at $21,699. The perch catch was over 325,000 pounds. In the catch of these species Currituck County leads all the other counties in the State.

In Tyrrell County over $14,000 has been added to the capital invested, and $12,323 to the value of products. The increase is mainly in the shad fishery, and amounts to 670,465 pounds, valued at $24,276 more than in 1890. This improvement is largely due to an increase in apparatus, over 6,000 nets having been added to the equipment. The alewife fishery has fallen off in both quantity and value, owing to the steadily diminishing demand for the species and the consequent low price.

Washington County is principally noted for its pound-net fishery, which employs 62 more nets than in 1890. The catch by this form of apparatus amounted to 754,178 pounds, valued at $14,652. In the matter of species caught in pound nets shad predominate, the value of this fish being more than half of the entire output of these nets.

The following tables show by counties the number of persons employed, the capital invested, and the yield of the fisheries:

Table showing by counties the number of persons employed in the fisheries of North Carolina in 1897.

Counties.	On vessels fishing.	On vessels transporting.	In shore or boat fisheries.	On boats transporting.	Shoresmen.	Total.
Beaufort	10	4	415		92	521
Bertie			350		194	544
Bladen			156			156
Brunswick		8	804			812
Camden		2	40		13	55
Carteret	368	51	1,210	2	210	1,844
Chowan		13	438		642	1,093
Craven		28	332	2	184	546
Currituck	7	4	539			550
Dare	64	50	1,306	4	58	1,482
Duplin			42			42
Edgecombe			103			103
Hertford			86		70	156
Hyde			389		32	421
Lenoir			260			260
Martin			151		30	181
New Hanover		8	691		13	712
Onslow			825	2		827
Pamlico			140			140
Pasquotank	6	3	177	2	17	205
Pender			172			172
Perquimans			92		95	187
Pitt			166			166
Sampson			190			190
Tyrrell		8	201	2	123	334
Washington		6	188		152	346
Total	455	188	9,463	14	1,925	12,045

Table showing by counties the vessels, boats, and apparatus employed in the fisheries of North Carolina in 1897.

Items.	Beaufort.		Bertie.		Bladen.		Brunswick.		Camden.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	2	$800								
Tonnage	18.69									
Outfit		263								
Vessels transporting	1	3,000					4	$2,250	1	$700
Tonnage	8.99						38.03		12.00	
Outfit		725						312		155
Boats fishing	201	4,453	134	$6,015	78	$720	221	4,075	26	1,590
Apparatus—vessel fisheries:										
Dredges	4	125								
Apparatus—shore fisheries:										
Seines	49	7,710	7	10,525			32	2,240		
Gill nets	2,817	2,870			48	864	38	380	1,900	2,850
Pound nets	54	5,400	96	7,305					47	2,355
Fyke nets									1	14
Minor nets	20	60	160	443	30	75	61	171		
Lines								60		
Pots	600	300								
Wheels			20	300						
Tongs and rakes							80	258		
Shore and accessory property		21,835		18,780				200		420
Cash capital		18,000								
Total		65,541		43,368		1,659		9,946		8,084

Vessels, boats, and apparatus employed in North Carolina fisheries in 1897—Continued.

Items.	Carteret.		Chowan.		Craven.		Currituck.		Dare.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	79	$60,100					1	$750	15	$7,350
Tonnage	849.18						11.99		128.74	
Outfit		17,579						245		2,950
Vessels transporting	19	11,125	4	$5,900	10	$5,750	2	650	24	17,850
Tonnage	250.52		50.42		106.10		13.92		281.03	
Outfit		1,374		350		530		165		2,730
Boats fishing	547	24,995	216	18,235	162	3,880	303	14,255	765	73,270
Boats transporting	1	180			1	350			3	1,000
Apparatus—vessel fisheries:										
Seines	11	5,125					1	225	5	1,125
Gill nets	49	1,370								
Dredges	22	730								
Tongs	119	300							20	60
Apparatus—shore fisheries:										
Seines	346	10,120	4	9,500	87	5,010	222	5,680	12	4,000
Gill nets	5,313	15,300	3,179	9,880	5,090	7,475	5,306	11,930	39,364	77,454
Pound nets			622	40,365	70	7,000	9	900	391	36,710
Fyke nets							7	175	1	50
Minor nets	100	25							30	5
Lines										79
Pots					200	100	181	272	95	132
Tongs and rakes	407	767							98	190
Miscellaneous		333								120
Shore and accessory property		76,625		51,818		32,400		1,620		26,440
Cash capital		65,400				25,000				
Total		291,448		136,048		87,495		36,867		251,515

Items.	Duplin.		Edgecombe.		Hertford.		Hyde.		Lenoir.		Martin.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats fishing	16	$180	53	$159	35	$923	172	$12,635	128	$797	85	$560
Apparatus—shore fisheries:												
Seines	10	200			4	2,800	75	1,500	17	510	2	1,200
Gill nets	6	90			135	275	7,200	7,700	125	125		
Pound nets					10	255	15	1,550				
Fyke nets					8	32					4	20
Minor nets			53	132					113	339	93	358
Lines												18
Pots											5	5
Wheels											50	750
Tongs and rakes							372	720				
Shore and accessory property		50				6,865		4,350		2,900		4,225
Cash capital								3,500				
Total		520		291		11,150		31,955		4,671		7,136

Items.	New Hanover.		Onslow.		Pamlico.		Pasquotank.		Pender.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing							1	$450		
Tonnage							8.60			
Outfit								290		
Vessels transporting	4	$1,850					1	900		
Tonnage	36.13						13.78			
Outfit		312						170		
Boats fishing	258	6,012	395	$7,525	70	$1,400	75	3,510	61	$775
Boats transporting	1	328					1	300		
Apparatus—vessel fisheries:										
Seines							1	225		
Apparatus—shore fisheries:										
Seines	38	2,880	10	2,000	10	300	23	4,220	17	1,225
Gill nets	160	4,845	655	9,825	800	800	2,704	4,248	31	540
Pound nets					14	1,400	28	1,100		
Fyke nets							2	50		
Minor nets	10	5					5	5	13	32
Lines		90								
Pots							100	50		
Tongs and rakes	85	233	210	605	100	250				
Shore and accessory property		20,475		250		100		9,577		105
Cash capital		21,000						5,500		
Total		58,030		20,205		4,250		30,595		2,677

Vessels, boats, and apparatus employed in North Carolina fisheries in 1897—Continued.

Items.	Perquimans.		Pitt.		Sampson.		Tyrrell.		Washington.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels transporting							4	$2,000	2	$1,200
Tonnage							33.52		17.59	
Outfit								370		230
Boats fishing	43	$2,750	70	$347	125	$1,250	100	6,050	78	3,890
Boats transporting							1	300		
Apparatus—shore fisheries:										
Seines	4	2,675	13	1,250	40	720			4	3,200
Gill nets	1,190	1,786			50	750	9,510	14,266	1,018	3,567
Pound nets	129	8,700					196	9,865	171	13,470
Minor nets			52	129	35	88				
Pots	52	26								
Shore and accessory property		4,635		2,225		75		3,204		25,990
Total		20,572		3,951		2,883		36,055		51,547

SUMMARY.

Items.	No.	Value.	Items.	No.	Value.
Vessels fishing	98	$69,450	Apparatus—shore fisheries:		
Tonnage	1,017.20		Seines	1,026	$79,465
Outfit		21,327	Gill nets	86,639	177,820
Vessels transporting	76	53,175	Pound nets	1,852	136,375
Tonnage	862.03		Fyke nets	23	341
Outfit		7,423	Minor nets	775	1,867
Boats fishing	4,420	200,251	Lines		247
Boats transporting	8	2,458	Pots	1,233	885
Apparatus—vessel fisheries:			Wheels	70	1,050
Seines	18	6,700	Tongs and rakes	1,352	3,023
Gill nets	49	1,370	Miscellaneous		453
Dredges	26	855	Shore and accessory property		315,164
Tongs	139	360	Cash capital		138,400
			Total		1,218,459

Table showing by counties and species the yield of the fisheries of North Carolina in 1897.

Species.	Beaufort.		Bertie.		Bladen.		Brunswick.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives, fresh	115,867	$3,252	1,223,834	$9,994				
Alewives, salted	46,000	695	1,516,357	12,540				
Black bass	3,100	155						
Blue-fish, fresh	4,500	90						
Butter-fish	5,725	85					17,800	$409
Cat fish	32,000	484	9,530	455				
Croakers, fresh	133,800	2,007						
Drum							41,875	838
Eels	25,000	750					2,500	75
Flounders	11,015	264						
Hickory shad	18,464	462	18,900	764			15,500	310
King-fish								
Mullet, fresh	2,375	81					19,125	478
Mullet, salted							12,300	333
Perch	60,498	2,638	15,020	610			333,100	9,942
Pig-fish								
Pike	8,250	240					44,802	1,532
Pin-fish								
Pompano	3,200	112					10,250	249
Sailor's choice								
Sea bass							12,500	313
Shad	232,986	11,367	489,964	18,747	31,698	$1,420	25,100	1,004
Sheepshead	8,350	292					10,125	450
Snappers							6,550	197
Spanish mackerel	4,250	149					11,150	279
Spots, fresh	58,275	874						
Squeteague, fresh	215,935	3,238					28,862	578
Strawberry bass	3,400	150					73,775	3,034
Striped bass	27,253	2,181	22,457	1,657				
Sturgeon	16,700	334					1,300	65
Suckers	8,100	170	18,840	563				
Sun-fish	3,900	125						
Whiting								
Shrimp							15,100	378
Terrapin							2,496	125
Turtles							4,500	630
Oysters	59,500	1,370					24,000	1,920
Clams								
Refuse			500,000	625			400,000	22,500
Total	1,108,443	31,565	3,814,902	45,955	31,698	1,420	1,112,710	45,639

Table showing the yield of the North Carolina fisheries in 1897—Continued.

Species.	Camden.		Carteret.		Chowan.		Craven.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives, fresh	69,400	$814	10,000	$150	2,454,708	$12,160	425,666	$6,385
Alewives, salted	8,333	75			5,352,679	39,859	50,000	1,000
Black bass	700	29					7,500	375
Blue-fish, fresh			536,235	9,395			100,000	2,000
Blue-fish, salted			60,600	1,560				
Bonito			2,350	35				
Butter-fish			36,225	723			35,000	525
Cat-fish	2,900	29			11,530	456		
Channel bass, fresh			18,900	286				
Croakers, fresh			267,575	2,156			215,000	1,075
Croakers, salted							25,000	250
Drum			30,600	612				
Eels					50	3	10,000	250
Flounders	3,000	90	35,125	703	1,095	42	29,700	297
Hickory shad	400	10			73,579	2,935	52,280	784
King-fish			192,365	3,848			45,275	904
Menhaden			11,310,000	19,700				
Mullet, fresh			179,675	2,734			39,850	389
Mullet, salted			774,100	22,922			50,000	1,000
Perch	12,700	367			67,950	2,618	117,700	3,532
Pig fish			145,265	2,910			25,000	500
Pike	780	31			200	16	44,600	446
Pin-fish			13,050	218			15,700	157
Pompano			45,325	1,362				
Porgy			16,650	240			18,210	182
Sea bass			113,950	2,553				
Shad	204,000	7,650			1,180,164	40,419	584,662	25,985
Sheepshead			116,555	3,245			13,650	680
Spanish mackerel			157,145	8,800			63,975	1,599
Spots, fresh			194,260	2,884			100,300	1,003
Spots, salted			36,700	943				
Squeteague, fresh			695,308	16,318			360,175	6,918
Squeteague, salted			47,450	1,242				
Strawberry bass							10,000	300
Striped bass	20,400	1,428	4,500	225	63,530	4,448	99.800	5,200
Sturgeon					100,475	2,453	75,000	3,750
Suckers	900	23			14,200	427		
Tautog			14,125	283				
Crabs, soft			979,200	3,400				
Terrapin			6,428	1,000				
Oysters			2,557,275	89,328				
Clams			307,408	19,213				
Scallops			118,323	5,653				
Caviar					10,360	3,248	10,125	3,375
Refuse					2,962,200	3,703		
Total	323,513	10,546	19,022,667	224,641	12,292,720	112,787	2,624,168	68,861

Species.	Hertford.		Hyde.		Lenoir.		Martin.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives, fresh	569,686	$8,085	2,000	$30	1,130	$10	21,333	$353
Alewives, salted	107,998	810					145,672	1,241
Blue-fish, fresh			68,650	1,029				
Blue-fish, salted			35,000	700				
Cat-fish	1,900	59			2,625	43	22,500	800
Croakers, fresh			10,300	154				
Drum			16,300	326				
Eels					150	3	1,000	60
Flounders			6,600	85				
Hickory shad	375	14			1,700	43	6,900	284
King-fish			2,500	25				
Mullet, fresh			29,650	444				
Mullet, salted			50,000	1,250				
Perch	5,200	157			3,175	127	5,200	260
Pig-fish			53,700	1,033				
Shad	48,380	1,772	252,000	11,200	91,200	3,427	126,000	5,265
Spanish mackerel			10,000	400				
Spots, fresh			81,100	1,087				
Squeteague, fresh			145,850	2,099				
Striped bass	1,350	83	8,250	680	4,315	303	13,800	1,136
Sturgeon					3,100	46		
Suckers	6,460	142			1,450	14	2,800	84
Oysters			1,666,700	45,583				
Clams			48,000	2,400				
Refuse							40,000	50
Total	741,349	11,122	2,486,600	68,525	108,845	4,016	385,205	9,533

Table showing the yield of the North Carolina fisheries in 1897—Continued.

Species.	Currituck.		Dare.		Duplin.		Edgecombe	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives, fresh	3,500	$21	284,080	$2,036	5,000	$60		
Alewives, salted	113,500	687	1,336,334	10,484				
Black bass	490,280	21,699			1,000	50		
Blue-fish, fresh	36,250	1,462	662,690	25,938				
Blue-fish, salted			118,200	2,884				
Butter-fish	400	16	8,800	280				
Cat-fish	62,446	868	6,050	170	1,200	24		
Channel bass, fresh			27,500	331				
Channel bass, salted			40,200	804				
Croakers, fresh	22,800	592	349,044	8,383				
Croakers, salted	2,000	80	4,400	92				
Eels	27,450	1,533	10,900	344				
Flounders	1,000	30	12,725	288				
Hickory shad			5,834	258	500	25		
King-fish	20,600	444	26,190	931				
Mullet, fresh	50,800	1,056	60,400	1,827				
Mullet, salted	10,000	500	479,410	10,460				
Perch	335,036	6,779	21,590	648	6,250	313		
Pike	36,840	1,634						
Pompano			4,650	254				
Scad or round robin	8,100	46						
Shad	364,400	13,665	3,147,128	133,017	18,900	840	11,925	$530
Sheepshead			81,826	3,416				
Spanish mackerel	2,300	166	79,470	6,561				
Spots, fresh	10,000	232	134,740	1,384				
Spots, salted	3,000	120	94,146	3,264				
Squeteague, fresh	51,200	2,210	865,895	35,310				
Squeteague, salted	8,000	400	28,046	584				
Striped bass	48,920	3,435	364,357	26,006	2,300	115		
Sturgeon			82,600	4,130				
Suckers	48,850	557			3,200	96		
Sun-fish	21,010	210						
Crabs, soft			2,400	144				
Terrapin			6,251	1,185				
Frogs	1,800	450						
Oysters			188,251	7,818				
Clams			25,600	890				
Squeteague sounds			691	104				
Total	1,780,482	58,892	8,560,398	290,225	38,350	1,523	11,925	530

Species.	New Hanover.		Onslow.		Pamlico.		Pasquotank.		Pender.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives, fresh			50,000	$600	26,666	$400	121,182	$1,203	1,660	$20
Alewives, salted							114,999	873		
Black bass	5,200	$260					20,712	729	450	23
Blue-fish, fresh	5,000	150	10,300	309	40,300	806			650	20
Butter-fish					8,600	129				
Cat-fish	17,300	519					8,500	255	750	15
Channel bass, fresh	3,150	63	15,000	150						
Croakers, fresh	84,025	1,601	48,850	977	50,400	252			23,950	479
Drum	2,000	60								
Eels							10,000	500		
Flounders	28,140	563	11,200	224	8,450	84			9,925	199
Hickory shad	8,700	435			6,000	210	1,468	44	200	10
King fish	38,000	760			14,015	238				
Mullet, fresh	242,660	6,067	78,200	1,564	15,650	156			85,865	2,146
Mullet, salted	39,750	1,193	868,300	26,049					7,500	225
Perch	17,175	859	10,000	300	30,610	918	31,200	1,102	3,150	158
Pig-fish	96,440	3,270	33,550	671	3,500	52			10,550	317
Pike	4,750	238			5,000	50				
Pin-fish	20,300	406			2,300	34				
Porgy					5,050	50				
Sailor's choice	26,500	662								
Sea bass	50,175	2,007								
Shad	236,781	13,155			49,500	2,200	234,912	8,858	19,687	875
Sheepshead	25,275	759	6,000	180	4,200	210			8,800	264
Snappers	23,250	581								
Spanish mackerel					13,700	342				
Spots, fresh	44,925	899	21,200	424	25,350	162			17,125	343
Squeteague, fresh	148,550	6,499	316,175	14,229	113,650	2,151	400	20	19,845	967
Strawberry bass	8,325	416								
Striped bass	8,000	400			18,800	853	19,401	1,570	875	44
Sturgeon	93,750	2,812								
Suckers							9,100	273	1,600	48
Sun-fish	13,300	665								
Warmouth bass	6,950	348								
Whiting	30,200	755								
Shrimp	144,000	5,760								
Crabs, soft	5,120	448								
Crabs, hard	40,000	1,000								
Oysters	448,000	28,000	840,000	60,000	252,000	9,000				
Clams	144,000	8,100	12,800	600						
Caviar	12,015	4,539								
Total	2,121,706	94,249	2,321,575	106,277	693,741	18,2 7	571,874	15,427	212,582	6,153

Table showing the yield of the North Carolina fisheries in 1897—Continued.

Species.	Perquimans.		Pitt.		Sampson.		Tyrrell.		Washington.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives, fresh	136, 579	$1, 640	7, 596	$227	13, 330	$160	55, 315	$550	95, 669	$606
Alewives, salted	79, 866	598					581, 499	4, 614	642, 999	4, 823
Black bass	2, 900	116			3, 500	175				
Cat-fish	5, 280	193	150	2	3, 200	96	100	1	4, 250	177
Eels	12, 150	608								
Flounders									500	20
Hickory shad	7, 450	224	2, 600	66	2, 000	50	3, 375	135	20, 250	830
Perch	16, 350	654	325	12	12, 250	613	10, 051	329	24, 950	1, 050
Shad	262, 824	9, 856	56, 632	2, 517	68, 400	3, 040	785, 440	29, 464	455, 780	17, 092
Striped bass	11, 010	764	75	6	4, 650	233	50, 830	3, 566	48, 950	3, 637
Suckers	7, 830	283			5, 300	159			6, 600	198
Refuse									360, 000	450
Total	542, 239	14, 936	67, 378	2, 830	112, 630	4, 526	1, 486, 609	38, 659	1, 659, 948	28, 883

SUMMARY.

Species.	Lbs.	Value.	Species.	Lbs.	Value.
Alewives, fresh	5, 694, 201	$48, 756	Sheepshead	271, 206	$9, 243
Alewives, salted	10, 096, 236	78, 299	Snappers	34, 400	860
Black bass	535, 342	23, 611	Spanish mackerel	330, 840	18, 017
Blue-fish, fresh	1, 482, 375	41, 608	Spots, fresh	716, 137	9, 870
Blue fish, salted	213, 800	5, 144	Spots, salted	133, 846	4, 327
Bonito	2, 350	35	Squeteague, fresh	3, 006, 758	92, 993
Butter-fish	94, 750	1, 758	Squeteague, salted	83, 496	2, 226
Cat-fish	192, 211	4, 646	Strawberry bass	21, 725	866
Channel bass, fresh	64, 550	830	Striped bass	845, 123	58, 035
Channel bass, salted	40, 200	804	Sturgeon	371, 625	13, 525
Croakers, fresh	1, 247, 619	18, 514	Suckers	135, 230	3, 037
Croakers, salted	31, 400	422	Sun-fish	88, 210	1, 000
Drum	51, 400	1, 073	Tautog	14, 125	283
Eels	96, 700	4, 051	Warmouth bass	6, 950	348
Flounders	173, 975	3, 199	Whiting	45, 300	1, 133
Hickory shad	230, 975	7, 583	Shrimp	146, 496	5, 885
King-fish	358, 070	7, 628	Crabs, soft	986, 720	3. 992
Menhaden	11, 310, 000	19, 700	Crabs, hard	40, 000	1, 000
Mullet, fresh	797, 425	16, 797	Terrapins	17, 179	2, 815
Mullet, salted	2, 612, 160	73, 541	Turtles	24, 000	1, 920
Perch	806, 379	24, 044	Frogs	1, 800	450
Pig-fish	412, 807	10, 285	Oysters	6, 011, 726	241, 099
Pike	100, 420	2, 655	Clams	937, 808	53, 703
Pin-fish	61, 600	1, 064	Scallops	118, 323	5, 653
Pompano	53, 175	1, 728	Caviar	32, 500	11, 162
Porgy	39, 910	472	Squeteaque sounds	691	104
Sailor's choice	39, 000	975	Refuse	3, 862, 200	4, 828
Scad or round robin	8, 100	46			
Sea bass	189, 225	5, 564	Total	64, 234, 257	1, 316, 017
Shad	8, 963, 488	362, 811			

VESSEL FISHERIES.

At the time of the last general canvass of this State (1890) vessel fishing was only prosecuted from two counties, Craven and Carteret. At the present time Beaufort, Carteret, Currituck, Dare, and Pasquotank counties have vessel fisheries.

A change is noted in the vessel fisheries of Carteret County in the establishment of an offshore vessel fishery. At the time of the investigation of these fisheries 11 vessels were thus engaged, each having a crew of 5 men and carrying 3 to 8 nets, known as "sink nets," which are 300 to 390 feet long and 5 to 6 feet deep, and are operated from rowboats, called "pilot boats," the boats being part of the equipment of each vessel. The method employed in fishing with them is as follows: Upon reaching the fishing-grounds in the open ocean each net is sunk to the bottom, where it is buoyed up by means of corks and marked on the surface by floats. After the last net is sunk a return is made to the first net, and each being lifted in its proper order the catch is carried to the vessel in waiting. The number of nets fished was 49, and the aggregate catch amounted to 416,258 pounds, with a value to the fishermen of $10,845. The vessels remain out for a week at a trip, the fishery covering a period of 8 to 10 months.

The purse seine is used in four counties, Carteret, Currituck, Dare, and Pasquotank. The total catch was 9,981,900 pounds, worth $21,886, and was composed of menhaden, striped bass, and squeteague. Menhaden comprise by far the greater portion, the catch being 9,930,000 pounds, valued at $17,400. They are taken only in Carteret County. In the other three counties striped bass and squeteague only are taken. The latter fishery is carried on in Albemarle Sound during the autumn months, and is of comparatively recent date.

A vessel fishery for oysters is carried on in Beaufort, Carteret, and Dare counties. The catch was 978,026 pounds, valued at $33,607, of which Carteret County furnished 843,675 pounds, valued at $29,029. The fishery in Dare County is conducted from Avon, and was inaugurated in 1892.

SHORE FISHERIES.

A glance at the tables shows that seines took by far the largest quantity of fish. They caught 16,248,447 pounds of fish, valued at $318,169. The fish secured in largest quantities are alewives, amounting to 5,864,348 pounds, valued at $55,153. The mullet and shad are each more valuable than the alewife, although the latter far exceeds them in quantity. 2,295,400 pounds of mullet, valued at $62,574, and 1,507,242 pounds of shad, valued at $60,235, were secured. The other prominent species of which more were secured in seines than in any of the other forms of apparatus were menhaden, black bass, perch, and spots.

The seine fisheries of Albemarle Sound section are the most important in the State. The seines, which are used for shad mainly, are among the largest employed in the United States. In Carteret County seines took 3,587,276 pounds, valued at $54,860. Craven County is next in this respect, the seine yield being worth $43,397, followed by Currituck, Bertie, Onslow, and Chowan counties, in the order named.

In Currituck Sound a peculiar form of seine is used. The net is knit like a small-meshed gill net and is about 150 yards long. At intervals of 3 or 4 yards oaken poles are run from the upper rope to the lower one and secured in this position. When in use a stake is driven into the muddy bottom and one end of the net secured to it. The boat is then rowed away from the stake, the net being paid out. When it is all out the boat is rowed about half of the arc of a circle around the stake and is then rowed in to the stake, when the net is hauled in. The net bags a little between the stakes and thus forms a pocket into which the fish go, and from which they are carefully lifted out of the water and dumped into the boat. The crosspieces of wood are used to prevent the net being pushed up by the heavy grass and allowing the fish to escape. The principal species taken in this net are black bass and perch.

So far as quantity is concerned, pound nets are second in importance, taking 14,080,660 pounds of fish, valued at $238,798. Alewives form the largest part of this catch, 9,554,989 pounds, worth $68,513, having been taken. The most important species in point of value, and the second so far as quantity is concerned, is the shad, of which 2,328,585 pounds, valued at $88,293, were taken. Other important species in point of value are striped bass, squeteague, and perch.

The increase in the number of pound nets in use in this State is remarkable. They were first introduced about 1874, and in 1880 only 117 were in use. In 1890 there were 950; in 1896, 1,700, and in 1897, 1,852. The Albemarle Sound region maintains the largest number of pound nets, followed by Pamlico and Croatan sounds. The great increase in the number of pound nets, owing to their efficiency, has had a marked effect on the use of other forms of apparatus.

Although gill nets occupy third place as regards the quantity of fish taken, they are first as regards value. This is explained by the large shad catch, which has a relatively high value. Somewhat more than half the shad catch of the State is taken in gill nets. The catch of shad was 4,916,952 pounds, valued at $205,079. The squeteague fishery is quite important, its value being $47,199, while the value of the mullet catch is $24,030. Dare County has a great preponderance in number of gill nets used and in the quantity and value of the catch, its principal species being shad and blue-fish. Tyrrell, New Hanover, Carteret, and Onslow counties rank in the order named so far as value of catch is concerned, although in the matter of quantity taken Carteret would be second, followed by Tyrrell, Onslow, Currituck, and New Hanover.

Gill nets are damaged a great deal by crabs, being frequently torn in getting them out of the meshes.

During the spring of 1898 several persons from the Northern States started a gill-net fishery for sturgeon in the ocean at Nags Head. They met with very good success and soon had imitators at various points along the "banks," more particularly at Whales Head, Kittyhawk, Oregon and New Inlets, and Hatteras. As this investigation was for the year 1897 this fishery does not appear in the statistical tables.

The line fishery is only prosecuted in New Hanover, Brunswick, Dare, and Martin counties. The total catch was 820,967 pounds, valued at $27,290. New Hanover secured almost twice as much as all the other counties. The principal species taken were squeteague and pig-fish.

Wheels are used only on the Roanoke River, where they secured 117,635 pounds, valued at $3,608. Alewives and shad were the principal species taken.

Eel pots are in use in 7 counties, the principal catch being made in Currituck County. The total yield was 93,000 pounds, valued at $3,913.

Fyke nets occupy a very insignificant position in the fisheries of the State. They are used in 6 counties, and the total catch was 26,207 pounds, valued at $865. Cat-fish formed over half of the quantity and and almost half of the value.

"Minor nets," including skim nets, dip nets, cast nets, and shrimp nets, secured a total of 1,328,117 pounds, valued at $13,688. Crabs occupy first place so far as quantity is concerned, while shad are first in value of catch. Carteret County is first in quantity and value, with 979,200 pounds of crabs, valued at $3,400.

Dredges, tongs, rakes, etc., are used in 7 counties. Their total catch was 6,089,831 pounds, valued at $266,848. Carteret County occupies first place, with 2,139,331 pounds, valued at $85,165. The products were oysters, clams, and scallops. The oysters are the most important, and form more than four-fifths of the total catch.

The terrapin and frogs enumerated in this table were taken by hand. The heading "refuse" refers to the refuse left after the alewives have been prepared for salting, and is sold as fertilizer.

Table showing by counties and species the yield of the seine fisheries of North Carolina in 1897.

Species.	Beaufort.		Bertie.		Brunswick.		Carteret.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Vessel fisheries:								
Menhaden							9, 930, 000	$17, 400
Shore fisheries:								
Alewives, fresh	95, 267	$2, 859	1, 012, 502	$7, 377				
Alewives, salted	46, 000	695	1, 069, 991	9, 108				
Black bass	3, 100	155						
Blue-fish, fresh					5, 300	$159	224, 500	4, 170
Blue-fish, salted							30, 200	780
Butter-fish							26, 175	523
Cat-fish	27, 260	413	7, 880	379				
Channel bass							9, 350	140
Croakers, fresh	50, 300	755			17, 875	358	160, 275	1, 495
Drum					2, 500	75	30, 600	612
Flounders	5, 275	178			5, 900	118	24, 725	495
Hickory shad	18, 464	462	4, 050	182				
King-fish							104, 590	2, 091
Menhaden							1, 380, 000	2, 300
Mullet, fresh	1, 075	61					119, 400	1, 833
Mullet, salted					297, 600	8, 877	630, 250	18, 606
Perch	50, 298	2, 128	11, 740	470				
Pig-fish							86, 345	1, 727
Pike	8, 250	240						
Pin-fish							8, 850	155
Pompano							25, 550	767
Porgy							10, 450	178
Sea bass							81, 225	1, 897
Shad	105, 411	4, 697	346, 364	12, 989				
Sheepshead	6, 250	250			3, 450	104	82, 455	2, 221
Spanish mackerel							47, 525	2, 547
Spots, fresh	45, 000	675			10, 312	207	103, 600	1, 526
Spots, salted							23, 400	585
Squeteague, fresh	63, 100	946			18, 725	832	335, 358	8, 280
Squeteague, salted							25, 600	678
Strawberry bass	3, 400	150						
Striped bass	22, 653	1, 813	11, 600	867	1, 300	65	1, 500	75
Suckers	8, 100	170	12, 700	373				
Sunfish	3, 900	125						
Tautog							8, 925	179
Turtles					24, 000	1, 920		
Terrapins					4, 500	630	6, 428	1, 000
Total	563, 103	16, 772	2, 476, 827	31, 745	391, 462	13, 345	3, 587, 276	54, 860
Total vessel and shore	563, 103	16, 772	2, 476, 827	31, 745	391, 462	13, 345	13, 517, 276	72, 260

Table showing the yield of the seine fisheries of North Carolina—Continued.

Species.	Chowan.		Craven.		Currituck.		Dare.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Vessel fisheries:								
Squeteague					900	$45	3, 700	$185
Striped bass					4, 300	387	32, 600	2, 949
Total					5, 200	432	36, 300	3, 134
Shore fisheries:								
Alewives, fresh	210, 000	$1, 095	400, 666	$6, 010			10, 000	30
Alewives, salted	1, 450, 003	10, 875	50, 000	1, 000			233, 334	1, 925
Black bass			7, 500	375	490, 280	21, 699		
Blue-fish, fresh			75, 000	1, 500	18, 900	765	12, 300	495
Butter-fish			30, 000	450				
Cat-fish	4, 000	160			50, 416	508	3, 300	99
Croakers, fresh			150, 000	750	9, 200	184	8, 500	255
Croakers, salted			25, 000	250				
Flounders	200	8	23, 200	232			1, 050	32
Hickory shad	23, 700	940	47, 280	709			1, 000	25
King-fish			35, 125	702	11, 000	330	1, 800	90
Mullet, fresh			39, 850	389	48, 800	976		
Mullet, salted			50, 000	1, 000				
Perch	10, 500	325	97, 700	2, 932	326, 236	6, 576	1, 800	54
Pig-fish			25, 000	500				
Pike			44, 600	446	36, 840	1, 634		
Pin-fish			15, 700	157				
Pompano							100	8
Porgy			18, 210	182				
Scad or round robin					8, 100	46		
Shad	249, 284	9, 311	325, 575	14, 470			72, 000	2, 700
Sheepshead			10, 000	500			2, 300	118
Spanish mackerel			48, 675	1, 217	1, 800	126		
Spots, fresh			60, 200	602	2, 800	56	5, 200	104
Squeteague, fresh			254, 600	4, 658	22, 000	880	46, 420	1, 901
Strawberry bass			10, 000	300				
Striped bass	8, 800	616	80, 900	4, 066	20, 000	1, 324	6, 200	430
Suckers	2, 000	60			48, 850	557		
Sun-fish					21, 010	210		
Total	1, 958, 487	23, 390	1, 924, 781	43, 397	1, 116, 232	35, 871	405, 304	8, 266
Total vessel and shore	1, 958, 487	23, 390	1, 924, 781	43, 397	1, 121, 432	36, 303	441, 604	11, 400

Species.	Martin.		New Hanover.		Onslow.		Pamlico.		Pasquotank.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Vessel fisheries:										
Squeteague									400	$20
Striped bass									10, 000	900
Total									10, 400	920
Shore fisheries:										
Alewives, fresh	10, 333	$155					16, 666	$250	97, 666	959
Alewives, salted	66, 670	500							107, 999	810
Black bass									20, 712	729
Blue-fish, fresh			5, 000	$150	10, 300	$309	22, 000	440		
Butter-fish							7, 600	114		
Cat-fish	4, 300	172							4, 800	144
Channel bass			3, 150	63						
Croakers, fresh			46, 375	848	10, 650	213	40, 200	201		
Drum			2, 000	60						
Flounders			13, 615	272	1, 000	20	5, 350	53		
Hickory shad	6, 000	240					4, 000	60	1, 400	42
King-fish							8, 300	124		
Mullet, fresh			168, 410	4, 210	33, 200	664	15, 650	156		
Mullet, salted			39, 750	1, 193	716, 800	21, 504				
Perch	2, 200	110					15, 310	459	24, 500	895
Pig-fish			21, 125	634	8, 200	164	3, 500	52		
Pike							5, 000	50		
Pin-fish							2, 300	34		
Porgy							5, 050	50		
Shad	62, 000	2, 325					22, 500	1, 000	12, 440	467
Sheepshead			19, 075	573			3, 000	150		
Spanish mackerel							5, 450	136		
Spots, fresh			22, 175	444			18, 350	92		
Squeteague			41, 960	2, 099	20, 450	920	55, 125	926		
Striped bass	5, 000	400	3, 700	185			10, 100	505	1, 200	84
Suckers	2, 000	60							2, 800	84
Shrimp			144, 000	5, 760						
Total	158, 503	3, 962	530, 335	16, 491	800, 600	23, 794	265, 451	4, 852	273, 517	4, 214
Total vessel and shore	158, 503	3, 962	530, 335	16, 491	800, 600	23, 794	265, 451	4, 852	283, 917	5, 134

Table showing the yield of the seine fisheries of North Carolina—Continued.

Species.	Duplin.		Hertford.		Hyde.		Lenoir.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Shore fisheries:								
Alewives, fresh	5,000	$60	553,337	$7,700			1,130	$10
Alewives, salted			107,998	810				
Black bass	1,000	50						
Blue-fish, fresh					28,000	$420		
Blue-fish, salted					35,000	700		
Cat-fish	1,200	24	1,400	42			2,100	32
Drum					16,000	326		
Hickory shad	500	25	300	10			1,700	43
Mullet, fresh					29,650	444		
Mullet, salted					50,000	1,250		
Perch	6,250	313	3,800	114			2,525	101
Pig-fish					15,100	302		
Shad	16,200	720	30,800	1,115			27,000	1,020
Spots, fresh					25,200	378		
Squeteague, fresh					56,250	843		
Striped bass	2,300	115	1,300	80			1,865	131
Suckers	3,200	96	4,300	93			1,150	11
Sturgeon							3,100	46
Total	35,650	1,403	703,235	9,964	255,500	4,663	40,570	1,394

Species.	Pender.		Perquimans.		Pitt.		Sampson.		Washington.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Shore fisheries:										
Alewives, fresh	1,660	$20	23,330	$340	7,596	$227	13,330	$160	16,670	$250
Alewives, salted			7,200	53					250,000	1,875
Black bass	450	23	2,900	116			3,500	175		
Blue-fish, fresh	650	20								
Cat-fish	750	15			150	2	3,200	96		
Croakers, fresh	17,700	354								
Flounders	8,300	166								
Hickory shad	200	10			2,600	66	2,000	50		
Mullet, fresh	47,465	1,186								
Mullet, salted	7,500	225								
Perch	3,150	158	3,100	124	325	12	12,250	613	5,000	250
Pig-fish	10,550	317								
Shad	8,100	360	36,408	1,365	29,160	1,296	36,000	1,600	128,000	4,800
Sheepshead	8,800	264								
Spots, fresh	12,275	246								
Squeteague, fresh	14,845	742								
Striped bass	875	44			75	6	4,650	223	20,000	1,600
Suckers	1,600	48					5,300	159	4,000	120
Total	144,870	4,198	72,938	1,998	39,906	1,609	80,230	3,086	423,670	8,895

SUMMARY.

Species.	Lbs.	Value.
Vessel fisheries:		
Menhaden	9,930,000	$17,400
Squeteague	5,000	250
Striped bass	46,900	4,236
Total	9,981,900	21,886
Shore fisheries:		
Alewives, fresh	2,475,153	27,502
Alewives, salted	3,389,195	27,651
Black bass	529,442	23,322
Blue-fish, fresh	401,950	8,428
Blue-fish, salted	65,200	1,480
Butter-fish	63,775	1,087
Cat-fish	110,756	2,086
Channel bass	12,500	203
Croakers, fresh	511,075	5,413
Croakers, salted	25,000	250
Drum	51,400	1,073
Flounders	88,615	1,574
Hickory shad	113,194	2,864
King-fish	160,815	3,337
Menhaden	1,380,000	2,300
Mullet, fresh	503,500	9,919
Mullet, salted	1,791,900	52,655
Perch	576,684	15,634
Pig-fish	169,820	3,696
Shore fisheries—Cont'd.		
Pike	94,690	$2,370
Pin-fish	26,850	346
Pompano	25,650	775
Porgy	33,710	410
Scad, or round robin	8,100	46
Sea bass	81,225	1,897
Shad	1,507,242	60,235
Sheepshead	135,330	4,180
Spanish mackerel	103,450	4,026
Spots, fresh	305,112	4,330
Spots, salted	23,400	585
Squeteague, fresh	928,833	23,027
Squeteague, salted	25,600	678
Strawberry bass	13,400	450
Striped bass	204,018	12,639
Suckers	96,000	1,831
Sun-fish	24,910	335
Sturgeon	3,100	46
Tautog	8,925	179
Shrimp	144,000	5,760
Turtles	24,000	1,920
Terrapins	10,928	1,630
Total	16,248,447	318,169
Total vessel and shore	26,230,347	340,055

Table showing by counties and species the yield of the gill-net fisheries of North Carolina in 1897.

Species.	Beaufort.		Bladen.		Brunswick.		Camden.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Shore fisheries:								
Croakers, fresh					11,500	$230		
Flounders					5,600	112		
Mullet, fresh					12,300	333		
Mullet, salted					20,500	615		
Pig-fish					7,200	216		
Shad	61,875	$3,750	22,248	$1,000			144,000	$5,400
Spots, fresh					10,950	219		
Squeteague, fresh					8,550	342		
Striped bass	850	68					2,400	168
Sturgeon	15,000	300						
Total	77,725	4,118	22,248	1,000	76,600	2,067	146,400	5,568

Species.	Carteret.		Chowan.		Craven.		Currituck.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Vessel fisheries:								
Blue-fish	53,650	$1,073						
Channel bass	5,750	89						
Croakers	49,500	296						
King-fish	23,025	462						
Mullet, fresh	30,075	448						
Mullet, salted	93,850	2,816						
Pig-fish	6,550	135						
Pompano	6,050	183						
Sea bass	9,300	188						
Sheepshead	8,775	265						
Spanish mackerel	41,070	2,466						
Squeteague	78,663	2,424						
Total	406,258	10,845						
Shore fisheries:								
Alewives, fresh	10,000	150						
Alewives, salted							112,500	$675
Blue-fish, fresh	258,085	4,152					17,300	695
Blue-fish, salted	30,400	780						
Bonito	2,350	35						
Butter-fish	10,050	200					400	16
Channel bass	3,800	57						
Croakers, fresh	57,800	365					13,600	408
Croakers, salted							2,000	80
Flounders	10,400	208						
King-fish	64,750	1,295					9,600	114
Mullet, fresh	30,200	453					2,000	80
Mullet, salted	50,000	1,500					10,000	500
Pig-fish	52,370	1,048						
Pin-fish	4,200	63						
Pompano	13,725	412						
Porgy	6,200	62						
Sea bass	23,425	468						
Shad			255,200	$9,570	236,250	$10,500	360,400	13,515
Sheepshead	25,325	759						
Spanish mackerel	68,550	3,787					500	40
Spots, fresh	90,660	1,358					4,200	86
Spots, salted	13,300	358					3,000	120
Squeteague, fresh	281,287	5,614					28,000	1,270
Squeteague, salted	21,850	564					8,000	400
Striped bass	3,000	150	16,400	1,148	5,700	342	13,900	974
Sturgeon			100,475	2,453	75,000	3,750		
Tautog	5,200	104						
Caviar			10,360	3,248	10,125	3,375		
Total	1,136,927	23,942	382,435	16,419	327,075	17,967	585,400	18,973
Total vessel and shore	1,543,185	34,787	382,435	16,419	327,075	17,967	585,400	18,973

Table showing by counties and species the yield of the gill-net fisheries of North Carolina in 1897—Continued.

Species.	Dare.		Duplin.		Hertford.		Hyde.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Shore fisheries;								
Blue-fish, fresh	577,390	$22,039					30,000	$450
Blue-fish, salted	118,200	2,884						
Butter-fish	3,800	130						
Channel bass	27,000	316						
Croakers, fresh	187,244	4,627						
Croakers, salted	4,400	92						
King-fish	20,500	614						
Mullet, fresh	60,400	1,827						
Mullet, salted	479,410	10,460						
Pig-fish							30,400	608
Pompano	1,600	84						
Shad	2,113,872	90,362	2,700	$120	17,100	$637	247,500	11,000
Sheepshead	65,925	2,656						
Spanish mackerel	13,470	1,281					10,000	400
Spots, fresh	111,500	899					40,300	502
Spots, salted	68,146	2,484						
Squeteague, fresh	619,800	23,645					43,500	566
Squeteague, salted	28,046	584						
Striped bass	32,510	2,154					4,750	400
Terrapins	6,100	1,152						
Squeteague sounds	691	104						
Total	4,540,004	168,394	2,700	120	17,100	637	406,450	13,926

Species.	Lenoir.		New Hanover.		Onslow.		Pamlico.		Pasquotank.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Shore fisheries:										
Alewives, fresh					50,000	$600			3,332	$35
Channel bass					15,000	150				
Croakers, fresh			12,500	$250	38,200	764				
Flounders			6,125	123	10,200	204				
Hickory shad			8,700	435						
Mullet, fresh			74,250	1,857	45,000	900				
Mullet, salted					151,500	4,545				
Perch					10,000	300				
Pig-fish					25,350	507				
Shad	25,000	$937	236,781	13,155			18,000	$800	213,880	8,039
Sheepshead					6,000	180				
Spots, fresh			7,500	150	21,200	424				
Squeteague, fresh			13,590	680	295,725	13,309				
Striped bass							500	20	5,965	428
Sturgeon			93,750	2,812						
Caviar			12,015	4,539						
Total	25,000	937	465,211	24,001	668,175	21,883	18,500	820	223,177	8,502

Species.	Pender.		Perquimans.		Sampson.		Tyrrell.		Washington.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Shore fisheries:										
Croakers, fresh	6,250	$125								
Flounders	1,625	33								
Mullet, fresh	38,400	960								
Shad	6,750	300	92,096	$3,454	22,500	$1,000	728,000	$27,310	112,800	$4,230
Spots, fresh	4,850	97								
Squeteague, fresh	5,000	225								
Striped bass			3,060	214			47,300	3,311	9,300	656
Total	62,875	1,740	95,156	3,668	22,500	1,000	775,300	30,621	122,100	4,886

Table showing by counties and species the yield of the gill-net fisheries of North Carolina in 1897—Continued.

SUMMARY.

Species.	Lbs.	Value.
Vessel fisheries:		
Blue-fish	53, 650	$1, 073
Channel bass	5, 750	89
Croakers	49, 500	296
King-fish	23, 025	462
Mullet, fresh	30, 075	448
Mullet, salted	93, 850	2, 816
Pig-fish	6, 550	135
Pompano	6, 050	183
Sea bass	9, 300	188
Sheepshead	8, 775	265
Spanish mackerel	41, 070	2, 466
Squeteague	78, 663	2, 424
Total	406, 258	10, 845
Shore fisheries:		
Alewives, fresh	63, 332	785
Alewives, salted	112, 500	675
Blue-fish, fresh	882, 775	27, 336
Blue-fish, salted	148. 600	3, 664
Bonito	2, 350	35
Butter-fish	14, 250	346
Channel bass	45, 800	523
Croakers, fresh	327, 094	6, 769
Croakers, salted	6, 400	172
Flounders	33, 950	680
Hickory shad	8, 700	435
Shore fisheries—Cont'd:		
King-fish	94, 850	$2, 023
Mullet, fresh	262, 550	6, 410
Mullet, salted	711, 410	17, 620
Perch	10, 000	300
Pig-fish	115, 320	2, 379
Pin-fish	4, 200	63
Pompano	15, 325	496
Porgy	6, 200	62
Sea bass	23, 425	468
Shad	4, 916, 952	205, 079
Sheepshead	97, 250	3, 595
Spanish mackerel	92, 520	5, 508
Spots, fresh	291, 160	3, 735
Spots, salted	84, 446	2, 962
Squeteague, fresh	1, 295, 452	45, 651
Squeteague, salted	57, 896	1, 548
Striped bass	145. 635	10, 033
Sturgeon	284, 225	9, 315
Tautog	5, 200	104
Terrapins	6, 100	1, 152
Caviar	32, 500	11, 162
Squeteague sounds	691	104
Total	10, 199, 058	371, 189
Total vessel and shore	10, 605, 316	382, 034

Table showing by counties the yield of the pound-net fisheries of North Carolina in 1897.

Species.	Beaufort.		Bertie.		Camden.		Chowan.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives, fresh	20, 600	$393	204, 332	$2, 512	69, 400	$814	2, 244, 708	$11, 065
Alewives, salted			348, 366	2, 550	8, 333	75	3, 902, 676	28, 984
Black bass					700	29		
Blue-fish	4. 500	90						
Butter-fish	5. 725	85						
Catfish	4, 740	71	1, 650	76	2, 400	24	7, 530	296
Channel bass, salted								
Croakers	83. 500	1, 252						
Eels							50	3
Flounders	5, 740	86			3, 000	90	895	34
Hickory shad			12, 300	463	400	10	49, 879	1, 995
Mullet	1, 300	20						
Perch	10, 200	510	1, 280	60	12, 200	362	57, 450	2, 293
Pike					700	28	200	16
Pompano	3, 200	112						
Shad	60, 300	2, 680	115, 200	4, 480	60, 000	2, 250	675, 680	21, 538
Sheepshead	2, 100	42						
Spanish mackerel	4, 250	149						
Squeteague	152, 835	2, 292						
Spots, fresh	13, 275	199						
Striped bass	3, 750	300	8, 857	630	18, 000	1, 260	38, 330	2, 684
Sturgeon	1, 700	34						
Suckers			1, 140	40	800	21	12, 200	367
Total	377, 715	8, 315	693, 125	10, 811	175, 933	4, 963	6, 989, 598	69, 275

Table showing by counties the yield of the pound-net fisheries of North Carolina in 1897—Continued.

Species.	Craven.		Currituck.		Dare.		Hertford.		Hyde.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives, fresh	25,000	$375	3,500	$21	274,080	$2,006	16,349	$385	2,000	$30
Alewives, salted			1,000	12	1,103,000	8,559				
Blue-fish	25,000	500	50	2	53,400	2,504			10,650	159
Butter-fish	5,000	75			5,000	150				
Cat-fish			1,030	30	2,350	59	300	11		
Channel bass, salted					40,200	804				
Croakers	65,000	325			146,000	3,282			10,300	154
Eels					1,500	32				
Flounders	6,500	65	1,000	30	11,675	256			6,600	85
Hickory shad	5,000	75			4,834	233	75	4		
King-fish	10,150	202			3,890	227			2,500	25
Perch	20,000	600	6,700	140	19,790	594	600	19		
Pig-fish									8,200	123
Pompano					2,950	162				
Shad	22,837	1,015	4,000	150	961,256	39,955	480	20	4,500	200
Sheepshead	3,650	180			9,400	470				
Spanish mackerel	15,300	382			66,000	5,280				
Squeteague	105,575	2,260	300	15	161,475	8,074			46,100	690
Spots, fresh	40,100	401			18,040	381			15,600	207
Spots, salted					26,000	780				
Striped bass	13,200	792	10,720	750	292,647	20,453	50	3	3,500	280
Sturgeon					82,600	4,130				
Suckers							2,000	46		
Total	362,312	7,247	28,300	1,150	3,286,087	98,391	19,854	488	109,950	1,953

Species.	Pamlico.		Pasquotank.		Perquimans.		Tyrrell.		Washington.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives, fresh	10,000	$150	19,918	$206	113,249	$1,300	55,315	$550	78,999	$356
Alewives, salted			7,000	63	72,666	545	581,499	4,614	392,999	2,948
Blue-fish	18,300	366								
Butter-fish	1,000	15								
Cat-fish			3,500	105	5,280	193	100	1	4,250	177
Croakers	10,200	51								
Flounders	3,100	31							500	20
Hickory shad	2,000	150	68	2	7,450	224	3,375	135	20,250	830
King-fish	5,715	114								
Perch	15,300	459	5,200	162	13,250	530	10,050	329	19,950	800
Shad	9,000	400	8,592	352	134,320	5,037	57,440	2,154	214,980	8,062
Sheepshead	1,200	60								
Spanish mackerel	8,250	206								
Squeteague	58,525	1,225								
Spots, fresh	7,000	70								
Striped bass	8,200	328	2,236	158	7,950	550	3,530	255	19,650	1,381
Suckers			6,000	180	7,830	283			2,600	78
Total	157.790	3,625	52,514	1,228	361,995	8,662	711,309	8,038	754,178	14,652

SUMMARY.

Species.	Lbs.	Value.	Species.	Lbs.	Value.
Alewives, fresh	3,137,450	$20,163	Pig-fish	8,200	$123
Alewives, salted	6,417,539	48,350	Pike	900	44
Black bass	700	29	Pompano	6,150	274
Blue-fish	111,900	3,621	Shad	2,328,585	88,293
Butter-fish	16,725	325	Sheepshead	16,350	752
Cat-fish	33,130	1,043	Spanish mackerel	93,800	6,017
Channel bass, salted	40,200	804	Squeteague	524,810	14,556
Croakers	315,000	5,064	Spots, fresh	94,015	1,258
Eels	1,550	35	Spots, salted	26,000	780
Flounders	39,010	697	Striped bass	430,620	29,824
Hickory shad	105,631	4,121	Sturgeon	84,300	4,164
King-fish	22,255	568	Suckers	32,570	1,015
Mullet	1,300	20			
Perch	191,970	6,858	Total	14,080,660	238,798

Table showing by counties the yield of the line fisheries of North Carolina in 1897.

Species.	Brunswick.		Dare.		Martin.		New Hanover.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Shore fisheries:										
Black bass							5, 200	$260	5, 200	$260
Blue-fish	12. 500	$250	19, 600	$900					32, 100	1, 150
Cat-fish					7, 000	$280	17, 300	519	24, 300	799
Channel bass			500	15					500	15
Croakers	12, 500	250	7, 300	219			25, 150	503	44, 950	972
Flounders	4. 000	80					8, 400	168	12, 400	248
King-fish	19. 125	478					38, 000	760	57, 125	1, 238
Perch							17, 175	859	17, 175	859
Pig-fish	37, 602	1, 316					75, 315	2, 636	112, 917	3, 952
Pike							4, 750	238	4, 750	238
Pin-fish	10, 250	249					20, 300	406	30, 550	655
Sailor's choice	12, 500	313					26, 500	662	39, 000	975
Sea bass	25. 100	1, 004					50, 175	2, 007	75, 275	3, 011
Sheepshead	3, 100	93	4, 000	160			6, 200	186	13, 300	439
Snappers	11. 150	279					23, 250	581	34, 400	860
Spots	7, 600	152					15, 250	305	22, 850	457
Squeteague	46, 500	1, 860	32, 500	1, 405			93, 000	3, 720	172, 000	6, 985
Strawberry bass							8, 325	416	8, 325	416
Striped bass					4, 000	400	4, 300	215	8, 300	615
Sun-fish							13, 300	665	13, 300	665
Warmouth bass							6, 950	348	6, 950	348
Whiting	15, 100	378					30, 200	755	45, 300	1, 133
Crabs, hard							40, 000	1, 000	40, 000	1, 000
Total	217, 027	6, 702	63, 900	2, 699	11, 000	680	529, 040	17, 209	820, 967	27, 290

Table showing by counties the catch by wheels operated in North Carolina in 1897.

Species.	Bertie.		Martin.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives, fresh			1, 000	$18	1, 000	$18
Alewives, salted	28, 000	$252	17, 335	156	45, 335	408
Cat-fish			10, 000	300	10, 000	300
Hickory shad	2, 100	98			2, 100	98
Perch	2, 000	80	3, 000	150	5, 000	230
Shad	12, 400	558	30, 000	1, 350	42, 400	1, 908
Striped bass	2, 000	160	4, 800	336	6, 800	496
Suckers	5, 000	150			5, 000	150
Total	51, 500	1, 298	66, 135	2, 310	117, 635	3, 608

Table showing by counties the yield of the fyke-net fisheries of North Carolina in 1897.

Species.	Camden.		Currituck.		Dare.		Hertford.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Cat-fish	500	$5	11, 000	$330	400	$12	200	$6
Eels								
Perch	500	5	2, 100	63			800	24
Pike	80	3						
Sheepshead					201	12		
Spots			3, 000	90				
Squeteague					2, 000	100		
Striped bass					400	20		
Suckers	100	2					160	3
Total	1, 180	15	16, 100	483	3, 001	144	1, 160	33

Species.	Martin.		Pasquotank.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives			266	$3	266	$3
Cat fish	1, 200	$48	200	6	13. 500	407
Eels			2, 000	100	2, 000	100
Perch					3, 400	92
Pike					80	3
Sheepshead					201	12
Spots					3, 000	90
Squeteague					2, 000	100
Striped bass					400	20
Suckers	800	24	300	9	1, 360	38
Total	2, 000	72	2. 766	118	26, 207	865

Table showing by counties the catch of eels by pots in North Carolina in 1897.

Counties.	Lbs.	Value.
Beaufort	25, 000	$750
Craven	10, 000	250
Currituck	27, 450	1, 533
Dare	9, 400	312
Martin	1, 000	60
Pasquotank	8, 000	400
Perquimans	12, 150	608
Total	93, 000	3, 913

Table showing by counties the catch by minor nets in North Carolina in 1897.

Species.	Beaufort.		Bertie.		Bladen.		Brunswick.		Carteret.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives, fresh			7, 000	$105						
Alewives, salted			70, 000	630						
Hickory shad			450	21						
Mullet, salted							15, 000	$450		
Shad	5, 400	$240	16, 000	720	9, 450	$420	10, 125	450		
Shrimp							2, 496	125		
Crabs, soft									979, 200	$3, 400
Total	5, 400	240	93, 450	1, 476	9, 450	420	27, 621	1, 025	979, 200	3, 400

Species.	Dare.		Edgecombe.		Lenoir.		Martin.		New Hanover.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives, fresh							10, 000	$180		
Alewives, salted							61, 667	585		
Cat-fish					525	$11				
Eels					150	3				
Hickory shad							900	44		
Perch					650	26				
Shad			11, 925	$530	39, 200	1, 470	34, 000	1, 590		
Striped bass					2, 450	172				
Suckers					300	3				
Crabs, soft	2, 400	$144							5, 120	$448
Total	2, 400	144	11, 925	530	43, 275	1, 685	106, 567	2, 399	5, 120	448

Species.	Pasquotank.		Pender.		Pitt.		Sampson.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives, fresh									17, 000	$285
Alewives, salted									131, 667	1, 215
Cat-fish									525	11
Eels									150	3
Hickory shad									1, 350	65
Mullet, salted									15, 000	450
Perch	1, 500	$45							2, 150	71
Shad			4, 837	$215	27, 472	$1, 221	9, 900	$440	168, 309	7, 296
Striped bass									2, 450	172
Suckers									300	3
Shrimps									2, 496	125
Crabs, soft									986, 720	3, 992
Total	1, 500	45	4, 837	215	27, 472	1, 221	9, 900	440	1, 328, 117	13, 688

Table showing by counties the catch by dredges, tongs, rakes, etc., in North Carolina in 1897.

Species.	Beaufort.		Brunswick.		Carteret.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Vessel fisheries:						
Oysters	59, 500	$1, 370			843, 675	$29, 029
Shore fisheries:						
Oysters					1, 713, 600	60, 299
Clams			400, 000	$22, 500	307, 408	19, 213
Scallops					118, 323	5, 653
Total			400, 000	22, 500	2, 139, 331	85, 165
Total vessel and shore	59, 500	1, 370	400, 000	22, 500	2, 983, 006	114, 194

Species.	Dare.		Hyde.		New Hanover.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Vessel fisheries:						
Oysters	74, 851	$3, 208				
Shore fisheries:						
Oysters	113, 400	4, 610	1, 666, 700	$45, 583	448, 000	$28, 000
Clams	25, 600	890	48, 000	2, 400	144, 000	8, 100
Total	139, 000	5, 500	1, 714, 700	47, 983	592, 000	36, 100
Total vessel and shore	213, 851	8, 708	1, 714, 700	47, 983	592, 000	36, 100

Species.	Onslow.		Pamlico.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Vessel fisheries:						
Oysters					978, 026	$33, 607
Shore fisheries:						
Oysters	840, 000	$60, 000	252, 000	$9, 000	5, 033, 700	207, 492
Clams	12, 800	600			937, 808	53, 703
Scallops					118, 323	5, 653
Total	852, 800	60, 600	252, 000	9, 000	6, 089, 831	266, 848
Total vessel and shore	852, 800	60, 600	252, 000	9, 000	7, 067, 857	300, 455

Table showing by counties the catch by miscellaneous apparatus for North Carolina in 1897.

Species.	Bertie.		Chowan.		Currituck.		Dare.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Terrapin							151	$33
Frogs					1, 800	$450		
Refuse	500, 000	$625	2, 962, 200	$3, 703				
Total	500, 000	625	2, 962, 200	3, 703	1, 800	450	151	33

Species.	Martin.		Washington.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Terrapin					151	$33
Frogs					1, 800	450
Refuse	40, 000	$50	360, 000	$450	3, 862, 200	4, 828
Total	40, 000	50	360, 000	450	3, 864, 151	5, 311

The shad is the preeminent fish in North Carolina so far as value is concerned. The following table shows the number caught during the years 1889, 1890, 1896, and 1897. The continued preponderance of Dare County in this fishery is clearly brought out, the catch in 1897 being almost one-third that of the entire State.

Table showing the number of shad taken in each county in North Carolina in 1889, 1890, 1896, and 1897.

Counties.	1889.	1890.	1896.	1897.
	No.	*No.*	*No.*	*No.*
Beaufort	59, 618	65, 050	54, 282	51, 774
Bertie	161, 050	106, 800	148, 950	122, 491
Bladen	....	....	6, 202	7, 044
Brunswick	6, 894	6, 741	7, 434	2, 250
Camden	26, 600	39, 375	33, 000	51, 000
Carteret	7, 571	5, 750	21, 151	....
Chowan	119, 126	125, 841	348, 898	270, 041
Columbus	....	....	1, 220	....
Cumberland	....	....	2, 265	....
Currituck	54, 400	70, 763	36, 053	91, 100
Dare	595, 217	690, 749	675, 700	786, 782
Duplin	4, 035	3, 210	3, 534	4, 200
Edgecombe	24, 046	20, 694	1, 960	2, 650
Gates	4, 300	4, 760	700	....
Greene	....	....	4, 193	....
Hertford	6, 354	8, 150	12, 870	12, 095
Hyde	19, 850	27, 780	50, 365	56, 000
Johnston	....	....	850	....
Lenoir	7, 000	7, 497	14, 787	21, 356
Martin	24, 000	26, 410	54, 089	31, 500
New Hanover	43, 677	37, 700	40, 038	52, 618
Onslow	7, 194	5, 543	....	....
Pamlico and Craven	145, 000	148, 000	160, 383	141, 000
Pasquotank	34, 479	37, 830	59, 398	58, 728
Pender	31, 783	26, 160	8, 492	4, 375
Perquimans	30, 390	27, 750	51, 324	65, 706
Pitt	8, 794	10, 736	13, 382	12, 585
Sampson	6, 714	5, 350	6, 130	15, 200
Tyrrell	28, 480	32, 850	156, 169	196, 360
Washington	73, 822	71, 105	119, 839	113, 945
Wayne	....	....	3, 146	....
Total	1, 530, 394	1, 612, 594	2, 096, 804	2, 170, 800

INDUSTRIES.

The shore enterprises of North Carolina dependent on the fisheries are of considerable importance. The prominent features of each of these is shown in the tables that follow, which are presented in a condensed form.

The menhaden business of North Carolina is centered in the vicinity of Beaufort, and six factories were operated in 1897. The capital invested in buildings, vessels, apparatus, etc., was $102,840, the number of persons employed was 200, the value of the fish handled was $19,605, and the value of manufactured products $35,527.

The wholesale trade and canning industry was carried on by 27 firms which included 1 establishment canning oysters and 1 canning clams. To avoid showing private business of these two canneries they have been combined with the firms dealing in fish, oysters, etc. The products sold had a value of $411,941. More than half of this amount represented fresh and salted fish, while the oysters that were sold open brought $100,181 for 149,181 gallons.

There was only one oyster-canning establishment in operation in 1897, and its output was small.

The oyster-packing industry shows a large decline, owing to the withdrawal of many firms formerly engaged in this business throughout the State. In Elizabeth City 13 firms thus engaged withdrew from the trade.

A new industry, that of canning clams, has been started at Ocracoke.

Table showing the extent of the menhaden industry of North Carolina in 1897.

Items.	No.	Value.	Items.	No.	Value.
Establishments	6	$57,000	Steam vessels fishing	3	$25,000
Cash capital		20,800	Tonnage	124.92	
Shore employees	73		Outfit and apparatus		4,200
Fishermen	127		Sail vessels fishing	8	6,350
Menhaden handled	19,250,000	19,605	Tonnage	113.92	
Tons of scrap prepared	1,330	24,450	Outfit and apparatus		5,340
Gallons of oil	61,550	11,077	Sail vessels transporting	4	4,400
			Tonnage	60.20	
			Outfit		550

Statement showing by localities the wholesale trade in fishery products for North Carolina in 1897.

Items.	Beaufort.		Elizabeth City.		Morehead City.		Newbern.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Establishments	4	$5,600	2	$2,695	6	$10,800	4	$25,400
Cash capital		14,200		5,500		23,900		25,000
Ice used ... tons	110	550	220	1,100	970	4,840	800	4,000
Salt used ... bush					700	210		
Employees ... No	61		7		19		184	
Products handled:								
Oysters sold open ... galls					24,927	15,066	50,754	36,065
Oysters canned ... cans	120,000	7,250						
Clams ... bush	5,000	4,500			23,250	20,925		
Scallops sold open ... galls					4,147	2,730		
Crabs, soft ... No					4,800	240		
Fish, fresh and salt ... lbs	350,000	14,000	1,048,833	39,475	1,406,868	56,274	1,565,000	60,600

Items.	Washington.		Wilmington.		Marshallberg, Ocracoke, and Belhaven.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Establishments	3	$9,000	4	$20,200	4	$8,650	27	$82,345
Cash capital		16,000		21,000		12,000		117,600
Ice used ... tons	540	2,700	410	2,050			3,050	15,240
Salt used ... bush	800	240					1,500	450
Employees ... No	14		13		147		445	
Products handled:								
Oysters sold open ... galls			18,000	13,500	55,500	35,550	149,181	100,181
Oysters canned ... cans							120,000	7,250
Clams ... bush							28,250	25,425
Clams canned ... cans					56,300	9,850	56,300	9,850
Scallops sold open ... galls							4,147	2,730
Crabs, soft ... No			37,200	2,015	120,000	6,500	162,000	8,755
Crabs, hard ... No			62,400	1,300			62,400	1,300
Shrimp ... bush			2,800	8,960			2,800	9,860
Fish, fresh and salt ... lbs	1,444,275	48,436	250,000	25,000			6,064,976	243,785
Caviar ... lbs			7,425	2,805			7,425	2,805

FISHERIES OF SOUTH CAROLINA.

The commercial fisheries of the State are carried on chiefly in the bays and near the outlets of the rivers in Beaufort, Charleston, and Georgetown counties, the cities of Charleston and Georgetown being the principal fishery centers. The fisheries of the interior waters are to a considerable extent for local use, shad comprising the principal part of the catch.

In the Charleston fish markets, both wholesale and retail, sea bass, whiting, and shad are the leading species. One species, not often found in fish markets, was the shark, which is skinned and cut up into strips and sold in small bunches of from 1 to 2 pounds, at 10 cents a bunch. Some 30,000 pounds of sharks are sold during the year to the negro population. All fresh fish are sold by the piece or the bunch, the latter being made up of small-sized pan-fish. Terrapin are found in more or less abundance in the bays, creeks, and inlets of Beaufort and Charleston counties, the larger portion being taken at or near McClellanville. Terrapin are secured by nets, and by hand-picking as found buried in the sand or mud, and are reported as becoming scarce. The sturgeon fishery is one of the most valuable branches of the fish business of Georgetown County. Sturgeon are taken by gill nets of from 12 to 15 inch mesh, and an average of 900 feet in length, being 20 to 22 feet deep. The sturgeon are all of quite large size, ranging from 100 to 300 pounds, with an average of 125 pounds. Occasionally much larger fish are taken. The sturgeon catch of Georgetown County is made in and near the mouth of the Santee River, in Winyah Bay and Waccamaw River as far as Laurel, the largest part of the catch being made in the lower end of Winyah Bay.

The shad is the most important species in this region, both as to quantity and value. The shad catch of Georgetown County is all made by means of gill nets fished in Winyah Bay, Waccamaw, Peedee, Black, and Santee rivers, the greater part being from Winyah Bay and Waccamaw River. The catch from the three last-mentioned rivers is mostly used locally. The shad nets employed in the waters of Winyah Bay and Waccamaw River are 5½-inch mesh, 1,000 to 1,200 feet in length and 22 feet deep. The shad catch is reported as having much improved of late years, as a result of large plantings of shad fry. The season's catch of 1897 and 1898 averages 500 shad to each net, the average weight being 4 pounds, with many of 6 and 8 pounds. One caught in Winyah Bay in February, 1898, was reported to have weighed 10 pounds.

The fisheries of this section are of much value to the city and county of Georgetown, where several firms act as agents for or partners of the fishermen, furnishing them with nets and supplies, and receiving, packing, and forwarding the catch to northern markets.

Beaufort County fisheries are chiefly represented in products by oysters, that are mostly sold to the canneries located at Ladies Island, near Beaufort, and canneries in Georgia, at Wilmington Island and Thunderbolt.

Small vessels from Savannah cruise along the waters of Beaufort County, buying a considerable amount of terrapin from the residents. Of the large variety of sea fishes to be found in this section very little attention is given to any except drum, which are plentiful, and weigh from 20 to 150 pounds. During the short run of drum, extending only through March and April, from 50 to 75 boats from Beaufort engage in the fishery, their aggregate catch for the season amounting to 150,000 to 200,000 pounds. Drum are sold by fishermen at from 25 to 50 cents apiece, or an average of about one-half cent a pound. They are mostly used locally, all surplus being shipped by steamer to Charleston.

The following series of tables contain condensed statistics of the fisheries of this State. There were employed in 1897, 2,139 persons, 59 of this number being engaged on vessels, 10 on vessels transporting, 1,865 in the shore and boat fisheries, and 205 were shoresmen. The investment in the fisheries of the State was $174,354. There were 12 fishing vessels, valued at $6,300; 1,056 boats were employed, worth $34,080. Gill nets constituted the most important form of apparatus of capture, and were valued at $23,840. Seines were valued at $3,045; tongs and rakes at $1,692. The shore property and the cash capital amounted to $93,855.

The yield of the fisheries of the State was 5,280,446 pounds, having a value of $210,456. The value of oysters taken was $45,360, of whiting $28,405, of shad $27,696, and of sea bass $26,356. The yield of shrimp was worth $18,395, sturgeon $7,325, caviar $17,525, terrapins $9,635.

Persons employed.

How engaged.	No.
On vessels fishing	59
On vessels transporting	10
In shore or boat fisheries	1,865
Shoresmen	205
Total	2,139

Table of apparatus and capital.

Items.	No.	Value.	Items.	No.	Value.
Vessels fishing	12	$6,300	Apparatus of capture—shore fisheries:		
Tonnage	224.90				
Outfit		3,157	Seines	87	$3,015
Vessels transporting	4	5,700	Gill nets	408	23,840
Tonnage	28.03		Cast nets	123	615
Outfit		585	Bow nets	20	60
Boats	1,056	34,080	Lines		985
Apparatus of capture—vessel fisheries:			Tongs and rakes	244	1,678
			Shore and accessory property		45,055
Seines	1	30	Cash capital		48,800
Lines		440			
Tongs	2	14	Total		174,354

Table of products.

Species.	Lbs.	Value.	Species.	Lbs.	Value.
Alewives	2,000	$40	Sheepshead	36,200	$1,460
Black bass	1,000	30	Snappers	54,000	1,660
Blue-fish	40,000	1,600	Spanish mackerel	10,000	1,000
Cat-fish	28,500	535	Spots and croakers	49,000	730
Channel bass	110,000	2,500	Squeteague	80,000	2,030
Drum	215,000	1,875	Striped bass	10,100	556
Groupers	33,000	1,170	Sturgeon	411,100	7,325
Hickory shad	36,800	1,516	Whiting	638,500	28,405
Mullet, fresh	46,000	885	Crabs	[1] 110,000	2,240
Mullet, salted	10,000	200	Shrimp	374,500	18,395
Perch	2,000	40	Terrapins	40,916	9,635
Pompano	5,000	300	Oysters	[2] 1,504,300	45,360
Sailor's choice	8,800	440	Clams	[3] 185,400	8,652
Sea bass	632,400	26,356	Caviar	69,805	17,525
Shad	506,125	27,696			
Sharks	30,000	300	Total	5,280,446	210,456

[1] 330,000 in number. [2] 214,900 bushels. [3] 23,175 bushels.

The tables presenting the fisheries of this State by counties show the most important fisheries to have been carried on in Charleston County, where 989 persons were employed, $104,747 invested, and the products valued at $124,473. In Georgetown County the yield of the fisheries was valued at $50,237, while in Beaufort County the value was $34,546. In Colleton County the fisheries are of small importance, the catch being confined to oysters, which were valued at $1,200.

Table showing the number of persons employed in the fisheries of South Carolina in 1897.

How engaged.	Beaufort County.	Charleston County.	Colleton County.	Georgetown County.	Total.
On vessels fishing		59			59
On vessels transporting		10			10
Boat or shore fishermen	477	873	25	490	1,865
Shoresmen	90	47		68	205
Total	567	989	25	558	2,139

Table showing by counties the vessels, boats, and apparatus employed in the fisheries of South Carolina in 1897.

Items.	Beaufort.		Charleston.		Colleton.*		Georgetown.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing			12	$6,300					12	$6,300
Tonnage			224.90						224.90	
Outfit				3,157						3,157
Vessels transporting			4	5,700					4	5,700
Tonnage			28.03						28.03	
Outfit				585						585
Boats	281	$5,740	405	17,195	25	$200	345	$10,945	1,056	34,080
Apparatus—vessel fisheries:										
Seines			1	30					1	30
Lines				440						440
Tongs			2	14					2	14
Apparatus—shore fisheries:										
Seines	18	650	43	1,865			26	500	87	3.015
Gill nets			79	3,600			329	20,240	408	23,840
Cast nets	25	125	98	490					123	615
Bow nets							20	60	20	60
Lines		100		870				15		985
Tongs and rakes	100	700	93	651			51	327	244	1,678
Shore and accessory property		3,680		32,850		25		8,500		45,055
Cash capital		8,000		31,000				9,800		48,800
Total		18,995		104,747		225		50,387		174,354

*No apparatus shown for this county. The men employed picked oysters from reefs by hand.

Table showing by counties and species the yield of the fisheries of South Carolina in 1897.

Species.	Beaufort.		Charleston.		Colleton.		Georgetown.		Total.	
	Lbs.	Value	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives							2,000	$40	2,000	$40
Black bass							1,000	30	1,000	30
Blue-fish			40,000	$1,600					40,000	1,600
Cat-fish			25,000	500			3,500	35	28,500	535
Channel bass	10,000	$500	100,000	2,000					110,000	2,500
Drum	180,000	1,350	35,000	525					215,000	1,875
Groupers			33,000	1,170					33,000	1,170
Hickory shad			3,800	76			33,000	1,440	36,800	1,516
Mullet, fresh	13,000	390	30,000	450			3,000	45	46,000	885
Mullet, salted							10,000	200	10,000	200
Perch							2,000	40	2,000	40
Pompano			5,000	300					5,000	300
Sailor's choice	800	40	8,000	400					8,800	440
Sea bass	6,000	300	626,400	26,056					632,400	26,356
Shad			28,125	1,406			478,000	26,290	506,125	27,696
Sharks			30,000	300					30,000	300
Sheepshead	1,200	60	35,000	1,400					36,200	1,460
Snappers			54,000	1,660					54,000	1,660
Spanish mackerel			10,000	1,000					10,000	1,000
Spots and croakers	6,000	300	43,000	430					49,000	730
Squeteague	4,000	200	67,000	1,480			9,000	350	80,000	2,030
Striped bass			5,100	306			5,000	250	10,100	556
Sturgeon			151,100	3,325			260,000	4,000	411,100	7,325
Whiting	42,000	1,700	595,000	26,675			1,500	30	638,500	28,405
Crabs	3,000	100	97,000	1,940			10,000	200	110,000	2,240
Shrimp	16,500	495	358,000	17,900					374,500	18,395
Terrapins	10,028	2,075	26,888	6,960			4,000	600	40,916	9,635
Oysters	998,200	23,680	329,000	19,000	84,000	$1,200	93,100	1,480	1,504,300	45,360
Clams	84,200	3,356	78,200	4,433			23,000	863	185,400	8,652
Caviar			12,430	3,181			57,375	14,344	69,805	17,525
Total	1,374,928	34,546	2,826,043	124,473	84,000	1,200	995,475	50,237	5,280,446	210,456

PRODUCTS IN RELATION TO APPARATUS.

The catch of the vessel fisheries amounted to 243,000 pounds, valued at $11,166. The principal part of the catch by vessels was made by lines, the fishes taken being sea bass, groupers, red snappers, and squeteague, with a total value of $8,816. The shore fisheries are of vastly greater importance. The catch by lines amounted to 1,766,200 pounds, with a value of $61,055; the catch by gill nets 1,030,630 pounds, with a value of $54,302. The yield of oysters and clams by tongs and by hand was worth $52,662. The catch by seines amounted to 191,516 pounds, valued at $12,681, while the yield by bow nets and cast nets was 379,000 pounds, worth $18,590.

Table showing by apparatus and species the yield of the vessel fisheries of South Carolina in 1897.

Species.	Seines.		Lines.		Tongs.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Groupers			18,000	$720			18,000	$720
Red snappers			4,000	160			4,000	160
Sea bass			196,400	7,856			196,400	7,856
Squeteague			3,000	80			3,000	80
Terrapins	2,000	$1,000					2,000	1,000
Oysters					14,000	$1,000	14,000	1,000
Clams					5,600	350	5,600	350
Total	2,000	1,000	221,400	8,816	19,600	1,350	243,000	11,166

NOTE.—All the vessel fisheries of South Carolina are centered at Charleston.

Table showing by counties, apparatus, and species the yield of the shore fisheries of South Carolina in 1897.

Apparatus and species.	Beaufort.		Charleston.		Colleton.		Georgetown.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:										
Channel bass	8,000	$400	50,000	$1,000					58,000	$1,400
Hickory shad			800	16					800	16
Mullet, fresh	10,000	300	30,000	450			3,000	$45	43,000	795
Mullet, salted							7,000	140	7,000	140
Sailor's choice	800	40							800	40
Sea bass	4,000	200							4,000	200
Spots			3,000	30					3,000	30
Squeteague	3,000	150	4,000	200			5,000	150	12,000	500
Striped bass			2,500	150					2,500	150
Whiting	2,000	100							2,000	100
Crabs							7,000	140	7,000	140
Shrimp	4,500	135	8,000	400					12,500	535
Terrapins	10,028	2,075	24,888	5,960			4,000	600	38,916	8,635
Total	42,328	3,400	123,188	8,206			26,000	1,075	191,516	12,681
Gill nets:										
Black bass							1,000	30	1,000	30
Hickory shad			3,000	60			25,000	1,000	28,000	1,060
Mullet, salted							3,000	60	3,000	60
Shad			28,125	1,406			478,000	26,290	506,125	27,696
Squeteague							4,000	200	4,000	200
Striped bass			2,600	156			5,000	250	7,600	406
Sturgeon			151,100	3,325			260,000	4,000	411,100	7,325
Caviar			12,430	3,181			57,375	14,344	69,805	17,525
Total			197,255	8,128			833,375	46,174	1,030,630	54,302
Lines:										
Blue-fish			40,000	1,600					40,000	1,600
Cat-fish			25,000	500			2,500	25	27,500	525
Channel bass			50,000	1,000					50,000	1,000
Drum	180,000	1,350	35,000	525					215,000	1,875
Groupers			15,000	450					15,000	450
Perch							2,000	40	2,000	40
Pompano			5,000	300					5,000	300
Sailor's choice			8,000	400					8,000	400
Sea bass	2,000	100	430,000	18,200					432,000	18,300
Sharks			30,000	300					30,000	300
Sheepshead	1,200	60	35,000	1,400					36,200	1,460
Snappers			50,000	1,500					50,000	1,500
Spanish mackerel			10,000	1,000					10,000	1,000
Spots and croakers	6,000	300	40,000	400					46,000	700
Squeteague			60,000	1,200					60,000	1,200
Whiting	40,000	1,600	595,000	26,675			1,500	30	636,500	28,305
Crabs	3,000	100	97,000	1,940			3,000	60	103,000	2,100
Total	232,200	3,510	1,525,000	57,390			9,000	155	1,766,200	61,055
Bow nets:										
Alewives							2,000	40	2,000	40
Cat-fish							1,000	10	1,000	10
Hickory shad							8,000	440	8,000	440
Total							11,000	490	11,000	490
Cast nets:										
Channel bass	2,000	100							2,000	100
Mullet	3,000	90							3,000	90
Squeteague	1,000	50							1,000	50
Shrimp	12,000	360	350,000	17,500					362,000	17,860
Total	18,000	600	350,000	17,500					368,000	18,100
Tongs and hand-picked:										
Oysters	998,200	23,680	315,000	18,000	84,000	$1,200	93,100	1,480	1,490,300	44,360
Clams	84,200	3,356	72,600	4,083			23,000	863	179,800	8,302
Total	1,082,400	27,036	387,600	22,083	84,000	1,200	116,100	2,343	1,670,100	52,662
Grand total	1,374,928	34,546	2,583,043	113,307	84,000	1,200	995,475	50,237	5,037,446	199,290

During 1897 the city of Charleston had $62,750 invested in the wholesale fish business, the quantity amounting to 2,756,480 pounds, having a value of $142,537. Of the quantity, 1,172,000 pounds were mullet, derived chiefly from Florida.

Table showing the extent of the wholesale fish trade of Charleston, S. C., in 1897.

Items.	Quantity, etc.	Value.
	Number.	
Establishments	6	$32,750
Cash capital		30,000
Tons of ice consumed	1,000	5,000
Employees	44	
Products handled:	*Pounds.*	
Blue-fish	3,000	210
Cat-fish	1,600	42
Channel bass	23,000	920
Drum	27,500	1,100
Groupers	32,000	1,280
Hickory shad	9,100	273
Mullet, fresh	1,172,000	46,760
Mullet, salted	3,000	150
Pompano	3,500	350
Shad	94,000	6,580
Sea bass	412,500	24,750
Sheepshead	72,000	3,600
Products handled—cont'd.	*Pounds.*	
Snappers	27,000	$1,350
Spanish mackerel	1,500	150
Spots and croakers	37,000	1,110
Squeteague	28,700	921
Striped bass	5,000	500
Sturgeon	67,000	2,830
Sun-fish and perch	11,500	575
Whiting	308,000	15,400
Other fish	44,000	2,200
Shrimp	13,600	680
Crabs, hard	95,500	2,865
Crabs, soft	1,600	200
Terrapins	18,700	8,770
Oysters	*80,255	8,599
Clams	†160,800	9,434
Caviar	3,125	938
Total	2,756,480	142,537

* 11,465 bushels.

† 20,100 bushels.

Table showing the extent of the oyster-canning industry of South Carolina in 1897.

Number of establishments	3
Value	$4,700
Cash capital	$9,100
Employees	133
Raw products utilized:	
Oysters .... bushels	62,840
Value	$6,284
Clams .... bushels	1,115
Value	$259
Oysters, 1-pound cans .... number	372,264
Value	$19,524
Oysters, 2-pound cans .... number	9,576
Value	$957
Clams, 1-pound cans .... number	13,200
Value	$655

Two of these canneries are located in Georgetown County and one in Beaufort County; those in the former county are mostly engaged in packing vegetables. Only the property, cash capital, and employees engaged in the oyster business are shown for these canneries.

FISHERIES OF GEORGIA.

In 1897, 1,869 persons were engaged in the fisheries of Georgia—159 in the vessel fisheries, 1,245 boat fishermen, and 465 shoresmen.

The investment in the fisheries amounted to $284,864. Fifty-one vessels were employed, worth, with their outfit, $28,833, and 680 boats, valued at $20,277. The apparatus of capture was valued at $17,898, while the shore property and cash capital amounted to $217,856.

The yield of the fisheries of this State was 4,993,100 pounds, worth $170,605. The most important items in the fisheries of Georgia are oysters, the yield being valued at $86,709, and shad, the value of which was $46,705. The catch of terrapin was valued at $11,254, and sturgeon at $4,060. The value of products, when compared with that of 1890, shows an increase of $47,042.

Persons engaged.

How engaged.	No.
In vessel fisheries	159
In shore or boat fisheries	1,245
Shoresmen	465
Total	1,869

Table of apparatus and capital.

Items.	No.	Value.	Items.	No.	Value.
Vessels fishing	51	$21,425	Apparatus—shore fisheries:		
Tonnage	641.80		Pound nets	4	$800
Outfit		7,408	Gill nets	424	11,905
Boats fishing	650	16,677	Seines	66	2,395
Boats transporting	30	3,600	Cast nets	82	385
Apparatus—vessel fisheries:			Minor nets	50	25
Dredges	5	50	Lines		205
Oyster tongs	37	266	Oyster tongs	203	1,469
Oyster grabs	173	236	Oyster grabs	134	162
			Shore and accessory property		106,356
			Cash capital		111,500
			Total		284,864

Table of products.

Species.	Lbs.	Value.	Species.	Lbs.	Value.
Alewives	25,000	$500	Squeteague	54,650	$2,512
Black bass	4,600	322	Striped bass	9,000	530
Cat-fish	157,600	2,734	Sturgeon	147,700	4,060
Channel bass	23,800	1,190	Sun-fish	3,900	195
Croakers	18,100	655	Whiting	45,700	2,100
Drum	14,300	592	Shrimp	67,600	2,535
Eels	5,000	100	Crabs	*a*74,660	1,864
Flounders	6,500	290	Terrapins	34,785	11,254
Hickory shad	7,775	262	Turtles	1,000	20
Mullet	56,000	1,310	Oysters	*b*3,406,440	86,709
Perch	3,600	140	Clams	*c*2,640	165
Sailor's choice	600	30	Caviar	9,600	2,581
Shad	787,559	46,705			
Sheepshead	25,000	1,250	Total	4,993,100	170,605

a 223,980 in number. *b* 486,634 bushels. *c* 330 bushels.

THE FISHERIES BY COUNTIES.

The most important fisheries of this State in respect to persons employed, capital invested, and value of products are located in Chatham County. The vessel fisheries are located here chiefly, and it not only leads in the yield of the principal products, but in nearly all of the minor products. The yield of the fisheries in Chatham County in 1897 was 3,162,745 pounds, valued at $127,621. The values of the products of the fisheries of the other counties are as follows: Glynn County, $22,678; Camden County, $7,000; McIntosh County, $6,900; Bryan County, $3,801; Wayne County, $2,380; Liberty County, $225.

Table showing by counties the vessels, boats, and apparatus employed in the fisheries of Georgia in 1897.

Items.	Bryan.		Camden.		Chatham.		Glynn.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing					39	$16,700	11	$4,475
Tonnage					533.32		98.33	
Outfit						5,625		1,630
Boats fishing	24	$184	58	$1,210	405	13,253	88	1,138
Boats transporting					30	3,600		
Apparatus—vessel fisheries:								
Dredges					5	50		
Oyster tongs					35	252	2	14
Oyster grabs					140	185	30	46
Apparatus—shore fisheries:								
Pound nets					4	800		
Gill nets	20	600	37	860	252	7,640	25	570
Seines					37	1,375	11	360
Cast nets					37	185	25	100
Minor nets					50	25		
Lines		8				142		35
Oyster tongs			20	140	177	1,287	6	42
Oyster grabs			78	78	50	75		
Shore and accessory property		1,000				72,056		33,000
Cash capital						101,500		10,000
Total		1,792		2,288		224,750		51,410

Items.	Liberty.		McIntosh.		Wayne.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing			1	$250			51	$21,425
Tonnage			10.15				641.80	
Outfit				153				7,408
Boats fishing	3	$24	51	690	21	$178	650	16,677
Boats transporting							30	3,600
Apparatus—vessel fisheries:								
Dredges							5	50
Oyster tongs							37	266
Oyster grabs			3	5			173	236
Apparatus—shore fisheries:								
Pound nets							4	800
Gill nets	3	75	61	1,560	26	600	424	11,905
Seines			18	660			66	2,395
Cast nets			20	100			82	385
Minor nets							50	25
Lines				20				205
Oyster tongs							203	1,469
Oyster grabs			6	9			134	162
Shore and accessory property				300				106,356
Cash capital								111,500
Total		99		3,747		778		284,864

Table showing the number of persons employed in the fisheries of Georgia in 1897.

Counties.	Vessel fishermen.	Boat fishermen.	Shoresmen.	Total.
Bryan		40		40
Camden		116		116
Chatham	126	769	331	1, 226
Glynn	30	170	131	331
Liberty		6		6
McIntosh	3	102	3	108
Wayne		42		42
Total	159	1, 245	465	1, 869

Table showing by counties and species the yield of the fisheries of Georgia in 1897.

Species.	Bryan.		Camden.		Chatham.		Glynn.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives					25, 000	$500		
Black bass	1, 400	$98			3, 200	224		
Cat-fish					154, 500	2, 685	300	$6
Channel bass					14, 100	705	2, 400	120
Croakers					11, 900	395	5, 300	215
Drum					8, 300	412	1, 500	45
Eels					5, 000	100		
Flounders							4, 300	180
Hickory shad	1, 000	28			4, 775	134	500	25
Mullet					32, 000	510	10, 500	260
Perch					3, 600	140		
Sailor's choice							200	10
Shad	72, 000	3, 600	28, 000	$1, 300	642, 600	38, 880	1, 750	105
Sheepshead					25, 000	1, 250		
Squeteague					20, 400	1, 020	26, 800	1, 120
Striped bass					4, 000	280	1, 200	60
Sturgeon			8, 700	230	75, 000	2, 550		
Sun-fish	1, 500	75			2, 400	120		
Whiting					24, 500	1, 225	18, 800	765
Shrimp					25, 600	960	42, 000	1, 575
Crabs					40, 100	1, 000	34, 560	864
Terrapins					20, 290	7, 045	7, 850	2, 548
Turtles					1, 000	20		
Oysters			311, 500	5, 350	2, 011, 690	65, 803	1, 027, 250	14, 780
Clams					2, 640	165		
Caviar			600	120	5, 150	1, 498		
Total	75, 900	3, 801	348, 800	7, 000	3, 162, 745	127, 621	1, 185, 210	22, 678

Species.	Liberty.		McIntosh.		Wayne.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives							25, 000	$500
Black bass							4, 600	322
Cat-fish			2, 800	$43			157, 600	2, 734
Channel bass			7, 300	365			23, 800	1, 190
Croakers			900	45			18, 100	655
Drum			4, 500	135			14, 300	592
Eels							5, 000	100
Flounders			2, 200	110			6, 500	290
Hickory shad			1, 500	75			7, 775	262
Mullet			13, 500	540			56, 000	1, 310
Perch							3, 600	140
Sailor's choice			400	20			600	30
Shad	3, 150	$225	15, 250	915	24, 800	$1, 680	787, 550	46, 705
Sheepshead							25, 000	1, 250
Squeteague			7, 450	372			54, 650	2, 512
Striped bass			3, 800	190			9, 000	530
Sturgeon			44, 000	880	20, 000	400	147, 700	4, 060
Sun-fish							3, 900	195
Whiting			2, 400	110			45, 700	2, 100
Shrimp							67, 600	2, 535
Crabs							74, 660	1, 864
Terrapins			6, 645	1, 661			34, 785	11, 254
Turtles							1, 000	20
Oysters			56, 000	776			3, 406, 440	86, 709
Clams							2, 640	165
Caviar			2, 650	663	1, 200	300	9, 600	2, 581
Total	3, 150	225	171, 295	6, 900	46, 000	2, 380	4, 993, 100	170, 605

THE FISHERIES WITH REFERENCE TO APPARATUS EMPLOYED.

The vessel fisheries of Georgia are devoted principally to the taking of oysters. Tongs are employed almost entirely, a limited number of dredges being used in Chatham County. Since 1890 the value of the yield of the vessel fisheries of the State has increased from $13,476 to $32,577. In the shore fisheries the yield by gill nets was valued at $56,455, the yield by seines at $13,399, by lines at $8,724. The value of the oysters taken by tongs was $54,132. The other forms of apparatus employed were pound nets and cast nets, the catch by which was not important.

Table showing by counties the yield of the vessel fisheries of Georgia in 1897.

Apparatus and species.	Chatham.		Glynn.		McIntosh.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Oyster tongs and grabs:								
Oysters	1,172,220	$21,721	852,250	$9,780	50,400	$576	2,074,870	$32,077
Oyster dredges:								
Oysters	7,000	500					7,000	500
Total	1,179,220	22,221	852,250	9,780	50,400	576	2,081,870	32,577

Table showing by counties, apparatus and species the yield of the shore fisheries of Georgia in 1897.

Apparatus and species.	Bryan.		Camden.		Chatham.		Glynn.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Pound nets:								
Alewives					25,000	$500		
Cat-fish					20,000	300		
Perch					200	10		
Striped bass					4,000	280		
Sun-fish					200	10		
Turtles					1,000	20		
Total					50,400	1,120		
Gill nets:								
Cat-fish							300	$6
Channel bass							500	25
Croakers							300	15
Flounders							4,300	180
Hickory shad	1,000	$28			4,775	134	500	25
Mullet							5,500	160
Sailor's choice							200	10
Shad	72,000	3,600	28,000	$1,300	642,600	38,880	1,750	105
Squeteague							26,800	1,120
Striped bass							1,200	60
Sturgeon			8,700	230	75,000	2,550		
Whiting							5,500	220
Caviar			600	120	5,150	1,498		
Total	73,000	3,628	37,300	1,650	727,525	43,062	46,850	1,926
Seines:								
Cat-fish					2,500	75		
Channel bass					900	45		
Croakers					700	35		
Mullet					500	15		
Whiting					3,000	150		
Shrimp					4,000	150	42,000	1,575
Crabs					2,600	100		
Terrapins					20,290	7,045	7,850	2,548
Total					34,490	7,615	49,850	4,123

Table showing by counties, apparatus and species, the yield of the shore fisheries of Georgia in 1897—Continued.

Apparatus and species.	Bryan.		Camden.		Chatham.		Glynn.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Cast nets:								
Cat-fish								
Channel bass					3,000	$150		
Mullet					31,500	495	5,000	$100
Whiting					5,000	250		
Shrimp					21,600	810		
Total					61,100	1,705	5,000	100
Lines:								
Black bass	1,400	$98			3,200	224		
Cat-fish					132,000	2,310		
Channel bass					10,200	510	1,900	95
Croakers					11,200	360	5,000	200
Drum					8,300	412	1,500	45
Eels					5,000	100		
Perch					3,400	130		
Sheepshead					25,000	1,250		
Squeteague					20,400	1,020		
Sun-fish	1,500	75			2,200	110		
Whiting					16,500	825	13,300	545
Total	2,900	173			237,400	7,251	21,700	885
Oyster tongs and grabs:								
Oysters			311,500	$5,350	832,470	43,582	175,000	5,000
Minor apparatus:								
Clams					2,640	165		
Crabs					37,500	900	34,560	864
Total					40,140	1,065	34,560	864
Grand total	75,900	3,801	348,800	7,000	1,983,525	105,400	332,960	12,898

Apparatus and species.	Liberty.		McIntosh.		Wayne.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Pound nets:								
Alewives							25,000	$500
Cat-fish							20,000	300
Perch							200	10
Striped bass							4,000	280
Sun-fish							200	10
Turtles							1,000	20
Total							50,400	1,120
Gill nets:								
Cat-fish			700	$11			1,000	17
Channel bass			1,500	75			2,000	100
Croakers			900	45			1,200	60
Flounders			2,200	110			6,500	290
Hickory shad			1,500	75			7,775	262
Mullet			7,500	300			13,000	460
Sailor's choice			400	20			600	30
Shad	3,150	$225	15,250	915	24,800	$1,680	787,550	46,705
Squeteague			5,200	260			32,000	1,380
Striped bass			3,800	190			5,000	250
Sturgeon			44,000	880	20,000	400	147,700	4,060
Whiting			1,000	40			6,500	260
Caviar			2,650	663	1,200	300	9,600	2,581
Total	3,150	225	86,600	3,584	46,000	2,380	1,020,425	56,455
Seines:								
Cat-fish							2,500	75
Channel bass							900	45
Croakers							700	35
Mullet							500	15
Whiting							3,000	150
Shrimp							46,000	1,725
Crabs							2,600	100
Terrapins			6,645	1,661			34,785	11,254
Total			6,645	1,661			90,985	13,399

Table showing by counties, apparatus, and species the yield of the shore fisheries of Georgia in 1897—Continued.

Apparatus and species.	Liberty.		McIntosh.		Wayne.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Cast nets:								
Cat-fish			2, 100	$32			2, 100	$32
Channel bass			700	35			3, 700	185
Mullet			6, 000	240			42, 500	835
Squeteague			2, 250	112			2, 250	112
Whiting			900	45			5, 900	295
Shrimp							21, 600	810
Total			11, 950	464			78, 050	2, 269
Lines:								
Black bass							4, 600	322
Cat-fish							132, 000	2, 310
Channel bass							17, 200	860
Croakers			5, 100	255			16, 200	560
Drum							14, 300	592
Eels			4, 500	135			5, 000	100
Perch							3, 400	130
Sheepshead							25, 000	1, 250
Squeteague							20, 400	1, 020
Sun-fish							3, 700	185
Whiting			500	25			30, 300	1, 395
Total			10, 100	415			272, 100	8, 724
Oyster tongs and grabs:								
Oysters			5, 600	200			1, 324, 570	54, 132
Minor apparatus:								
Clams							2, 640	165
Crabs							72, 060	1, 764
Total							74, 700	1, 929
Grand total	3, 150	$225	120, 895	6, 324	46, 000	$2, 380	2, 911, 230	138, 028

The wholesale trade in fresh fish, oysters, etc., is largely centered at Savannah. During the year 1897, 7 firms were in operation in the State; the value of property amounted to $51,074; the cash capital required was $61,000; the value of products sold was $202,975. Of this amount $71,320 represented the value of 1,783,000 pounds of mullet, which were obtained from Florida.

Table showing the extent of the wholesale trade in fishery products for Georgia in 1897.

Items.	No.	Value.	Items.	No.	Value.
Establishments	7	$47, 774	Products handled—cont'd.	*Pounds.*	
Cash capital		61, 000	Sea bass	47, 000	$3, 290
Collecting boats	29	3, 300	Shad	197, 000	16, 645
Tons of ice consumed	2, 350	7, 800	Sheepshead	66, 000	4, 620
Employees	57		Spanish mackerel	18, 000	2, 160
			Squeteague	45, 000	3, 600
Products handled:	*Pounds.*		Sturgeon	73, 000	6, 570
Alewives	13, 000	390	Sun-fish and perch	55, 000	3, 850
Cat-fish	6, 000	120	Terrapins	36, 433	18, 658
Channel bass	36, 500	2, 555	Shrimp	14, 800	1, 530
Croakers	17, 000	1, 190	Crabs	36, 000	2, 600
Groupers	119, 000	3, 555	Oysters	*439, 250	41, 015
Hickory shad	30, 900	2, 468	Clams	†1, 600	100
Mullet	1, 783, 000	71, 320	Caviar	4, 375	1, 303
Pompano	18, 800	2, 256			
Red snapper	295, 000	11, 800	Total	3, 364, 158	202, 975
Striped bass	11, 500	1, 380			

* Represents 62,750 bushels.

‡ Represents 200 bushels.

NOTE.—Five of these firms are located in Savannah; the other two have but little property and capital and handle most of the terrapin shown in table.

In the wholesale fish and oyster trade and oyster-canning business of Savannah during the year 1897, the capital invested was $169,526; persons employed, 296; fresh fish handled, 2,895,875 pounds; gallons of oysters, 71,500; oysters canned, 1,261,884 cans; the value of products was $281,052.

Oyster-canning industry.

Items.	No.	Value.	Items.	No.	Value.
Establishments	3	$34,000	Oysters utilized....bush..	363,998	$49,993
Private oyster grounds		20,000	Oysters as sold:		
Cash capital		50,000	One-pound cans.....no..	1,502,619	82,794
Ice consumed........tons..	50	150	Two-pound cans....no..	115,224	11,353
Salt....................lbs..	29,625	256	Shucked...........galls..	29,500	23,600
Employees	383		In shell ....bush..	1,400	1,400
			Shells.............do....	400,051	8,001

NOTE.—One cannery located in Brunswick, 1 at Thunderbolt, and 1 at Wilmington Island. The two latter canneries are operated by firms at Savannah.

Of the products from the waters of the State, shad are most important, and, with oysters and terrapin, constitute the principal part of the wholesale business. They are well distributed through the inland waters and furnish a fine food supply for local consumption. When there are transportation facilities the surplus is shipped to distant markets.

Of the numerous rivers that receive large runs of shad, the following are the most important: Savannah, Ogeechee, Altamaha, Ocmulgee, Oconee, Satilla, and St. Marys. The first arrivals from the ocean are looked for soon after the 1st of January, and by the middle of the month a good run may be expected, the season lasting about three months. The bulk of the catch is taken by gill nets used within a few miles of the mouths of the rivers. The quantity taken through the interior is not large at any one place, but is quite important in the aggregate.

More attention is being given to the sturgeon fishery than formerly. There is an increasing demand, and high prices are received for sturgeon and its roe. The catch is made mostly between March and June.

The oyster industry shows a large gain in the amount gathered, the greater part of which is steamed and canned. This branch of the fishing industry gives employment to several hundred employees at the factories. Oysters are gathered principally from natural beds, and are known as raccoon oysters. The beds are located at numerous places in the estuaries, lagoons, and bays bordering on or near the ocean, and are entirely exposed at low tide. The exact location being known, at high tide the small sailing vessels employed as transporters sail near the beds and anchor. Large skiffs, or rough boats, are then taken from the vessel and anchored over the oyster-grounds. At low tide the men from the vessel have only to land on the oyster beds and with naked hands or "hand-grabs" gather the oysters, throwing them into the boats. which. on the return tide. are unloaded on the vessel.

The "grabs" used are small hand irons made like ice tongs, but having numerous prongs to take up the oysters. The oysters are of small size, but good flavor.

The process of canning steamed or "cove" oysters is simple. The shell oysters are unloaded on the wharf at the cannery. Gangs of men are employed in filling long slatted iron trucks, which hold some 12 to 15 bushels each. As soon as filled they are run into long steam chests made of iron, or occasionally of wood; the door being closed, and steam turned on, only a few moments are required to steam the oysters enough to open all the shells. The cars are now run out and emptied on the floor and on long tables in the factory. The men, women, and children now begin their work of picking the oysters from the shells; they having been cooked enough to nearly free them from the same, it requires no skill and but little effort to pick the shells clean. As soon as the picker's dish is filled it is taken to the weigher, and a brass check is given which represents the amount due for picking, the price being about 1½ cents a pound. The oysters are now emptied into a trough, where they receive a thorough washing, which cleans them from all dirt that has become attached in opening and picking. They now go to the filling tables, where they are placed in the cans. The cans being then filled up with salt water and the tops sealed on, they are put into crates that are placed in iron retorts and receive 8 to 10 pounds of steam until thoroughly cooked. All that now remains to be done is the labeling and packing.

After the oyster season is closed many of the oystermen turn their attention to gathering terrapin. Within the past few years this business has increased and a scarcity of terrapin is now reported. Small vessels from Savannah and vicinity cruise along the coast between Fernandina, Fla., and Georgetown County, S. C., buying terrapin from the residents, who gather them along the bays and creeks that receive tide waters. When the vessel returns to the home station, the terrapin are put into small yards, usually near the water. When in captivity terrapin are fed chiefly on shrimp. They soon become quite tame and are on hand at feeding time. The catch to stock up a terrapin yard for its winter demand must be made during the summer or early fall. The demand is confined to a few winter months, mostly in December and January. During this time they do not require and will not take any food, yet do not appear to grow poor. The catch is made with nets and by hand-picking. Dogs are often employed in tracking the terrapin from the water to the marshes, where they are found buried a few inches in the sand or mud.

Some little attention has been given to the propagation of terrapin, but only in an experimental way, and it is demonstrated that they can be hatched out in confinement and have thrived. The main objection to propagation seems to be the slow rate of growth, requiring a number of years' delay to realize from the venture, and six months or more of each year they must be fed.

Most of the terrapin are sold in Northern cities, where many of the leading hotels and clubs have standing orders for regular shipments during the season. Terrapin are classed as counts, three-quarters, one-half, and bulls, prices varying from $8 to $12, as to size, except for the bulls, which are not desirable and bring but little money. The sizes and average weights are as follows:

Designation.	Average weight.	Average size.
Counts	2½ pounds each	6 to 8 inches, mostly 6½.
Three-fourths	1½ pounds each	5½ to 6 inches.
One-half	11 pounds per dozen	5 to 5½ inches.
Bulls	½ pound each	4 to 4½ inches.

FISHERIES OF EASTERN FLORIDA.

Next to North Carolina, eastern Florida has probably the most favorable geographical situation for prosecuting the fisheries of any of the South Atlantic States. The general coast line is about 450 miles in length, but the numerous rivers, bays, sounds, and lagoons give the State a much more extensive shore line. The most important of these are the St. Marys River, which forms the dividing line between Georgia and Florida, Nassau River and Sound, the St. Johns River, Matanzas River, Halifax River, Mosquito Lagoon or Hillsboro River, Indian River, St. Lucie Sound, Lake Worth, and Biscayne Bay. With the exception of the St. Marys and St. Johns rivers these waters are lagoons or arms of the sea, from which they are separated by low, sandy bars. There are openings at frequent intervals connecting the ocean and lagoons, and through these the marine fishes find their entrance. The Indian River is a typical specimen of this kind. It is about 135 miles in length, and runs parallel to the ocean, being separated from it by a narrow sandy strip of land which nowhere rises more than a few feet above the water. The river's width varies from only a few rods at Jupiter Narrows to 5 or 6 miles just below Titusville. The average depth is about 6 or 7 feet. These lagoons or rivers are favorite resorts for the marine fishes, some of which come in to spawn. The waters are generally salty, but during heavy rains they sometimes become fresh in all parts except near the inlets.

The principal fishing centers are Fernandina, at the extreme northeastern end of the State; Mayport, Fulton, New Berlin, Jacksonville, Palatka, and Sanford, on the St. Johns River; St. Augustine, on Matanzas River; Ormond, Daytona, and New Smyrna, on Halifax River and Mosquito Lagoon; Titusville and Cocoa, on Indian River; Fort Pierce and Eden on St. Lucie Sound; West Palm Beach, on Lake Worth, and Miami, on Biscayne Bay.

In 1890 eastern Florida held second place among the South Atlantic States in quantity and value of fishery products. This is still true with regard to the quantity of products taken, but not as to value. In 1890, 7,463,531 pounds of fishery products were taken, valued at $219,870, while the catch in 1897 was 5,882,662 pounds, worth $136,077, a loss of 1,580,869 pounds and $83,793. This is mainly attributable to the falling off in the shad and oyster fisheries.

The most prominent fisheries are those for shad and mullet. Considerably over half of the total catch and almost half of the total value are represented in these two fisheries. The other leading fisheries are those for squeteague, sheepshead, channel bass, pompano, and oysters.

Gill nets, seines, and tongs are the principal apparatus of capture. Cast nets, lines, and other minor forms of apparatus are also in use. The absence of the pound net in this section is noticeable. During the latter part of 1897 a pound net was located in the ocean near Cape Canaveral, but was put in operation too late in the year to be included in the present canvass. Pound nets have been tried before in different sections of the State, but without success, the nets being destroyed by sharks and other predatory species.

The absence of a vessel fishery is also noticeable. There are numerous snapper banks a short distance off the Florida coast, which are resorted to by New England fishing smacks, which land their catch at Savannah. Such a fishery could be carried on more easily and economically by Florida fishermen, as they are closer to the banks. Several vessels from Punta Gorda, on the western coast of the State, have made trips to Biscayne Bay for the purpose of catching Spanish mackerel.

Very little ocean fishing is done by the fishermen of this region, a few seines only being hauled on the beaches. Although the waters adjacent to the coast teem with marine food-fishes, the fishermen have generally confined their attention to the rivers and lagoons.

From 1880 to 1890 there was an increase in the fisheries of eastern Florida, but since that time there has been a decline in the fisheries as a whole. The decline is especially noticeable in the sun-fish, shad, shrimp, oyster, and turtle fisheries. The sturgeon fishery, which was at one time quite important, is now extinct. The species in the catch of which noticeable increases are shown are alewives, blue-fish, channel bass, mullet, pompano, sheepshead, and squeteague. A part of the general decline is attributable to the laws governing certain of the rivers. No nets are now allowed in any of the fresh-water rivers or bayous, except for shad, and only cast nets and lines are allowed in Mosquito Lagoon or Hillsboro River and Halifax River. These latter formerly had quite extensive fisheries. Another law, put into force in the State in 1897, prohibited the use of nets (except cast nets) in all the waters of the State, from June 15 to August 16, and the catching of mullets between November 15 and December 31. These restrictions account for a considerable part of the decrease in the total catch.

In 1897 there were 1,132 persons employed in the fisheries, of which number 986 were engaged in the shore and boat fisheries. The capital invested amounted to $151,155. The shore and accessory property was valued at $64,715. The apparatus of capture was valued at $32,210, and the boats employed at $19,800. The item of cash capital is placed at $29,100. The total value of the products was $136,077. The yield of shad alone was valued at $41,572, while the next most important species was mullet, the value of the yield of which was $22,732. The catch of pompano was valued at $13,093, while squeteague and oysters, the species next in importance, were valued at $12,817 and $11,766, respectively.

As compared with the last general canvass of this region (1890) there has been a decrease in the number of persons employed and in the apparatus used, although there has been an increase in the shore property (caused by the putting up of more substantial buildings) and cash capital. The statistics for this State were collected for the fiscal year ending June 30, 1897.

The three following tables show the extent of the fishery interests of the eastern part of Florida in condensed form:

Persons employed.

How engaged.	No.
On vessels transporting	5
Shore or boat fisheries	986
Shoresmen	141
Total	1,132

Table of apparatus and capital.

Items.	No.	Value.
Vessels transporting	2	$2,400
Tonnage	16.87	
Outfit		1,930
Boats	527	19,800
Apparatus of capture:		
Seines	44	3,735
Gill nets	487	28,547
Cast nets	30	165
Turtle nets	37	380
Lines		46
Tongs	51	337
Shore and accessory property		64,715
Cash capital		29,100
Total		151,155

Table of products.

Species.	Lbs.	Value.	Species.	Lbs.	Value.
Alewives, fresh	33,913	$404	Spots and croakers	23,133	$772
Alewives, salted	5,000	125	Squeteague	516,370	12 817
Black bass	52,516	2,184	Sun-fish	248,989	6,827
Blue-fish	46,421	1,121	Whiting	8,000	365
Cat-fish	124,000	3,720	Other fish	103,340	3,356
Channel bass or red-fish	235,782	3,542	Oysters	*362,802	11,766
Drum	17,000	175	Clams	4,800	300
Mullet, fresh	2,341,957	21,156	Craw-fish	4,000	80
Mullet, salted	71,400	1,576	Crabs	3,700	175
Pompano	196,344	13,093	Shrimp	38,625	1,497
Sea bass	5,570	210	Turtles	23,856	1,751
Shad	1,011,180	41,572	Terrapins	10,350	1,425
Sheepshead	390,164	5,908			
Spanish mackerel	3,450	160	Total	5,882,662	136,077

*Represents 51,829 bushels.

THE FISHERIES CONSIDERED BY COUNTIES.

Commercial fishing in eastern Florida is carried on in eight counties. Duval County easily ranks first in the number of men employed, value of investment, and in value of catch, and is second in the quantity of products taken. This is accounted for by the fact that the lower reaches of the St. Johns River are wholly in Duval County, and these support large shad fisheries. The shad catch of this county is more than double that of all the other species combined. Brevard County is first in the quantity of fishery products taken and second in men employed and value of investment. The Indian River is wholly within this county. Orange and Putnam are inland counties, and their fisheries are wholly on the St. Johns River.

The following tables show the number of persons employed, the apparatus, the capital, and the yield of the different species:

Table showing the number of persons employed in the fisheries of eastern Florida.

Counties.	On vessels transporting.	Shore or boat fisheries.	Shoresmen.	Total.
Nassau		99	40	139
Duval	3	339	35	377
Putnam		60	3	63
Orange		130	11	141
St. John		74	13	87
Volusia		30	4	34
Brevard	2	222	30	254
Dade		32	5	37
Total	5	986	141	1,132

Table showing by counties the apparatus and capital employed in the fisheries of the eastern coast of Florida.

Designation.	Nassau.		Duval.		Putnam.		Orange.		St. John.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels transporting			1	$2,000						
Tonnage			8.78							
Outfit				1,850						
Boats	86	$710	163	7,680	28	$565	66	$990	30	$480
Apparatus of capture—shore fisheries:										
Seines			4	800	2	200	30	2,100	4	180
Gill nets	33	620	192	17,200	24	1,350	4	72	8	160
Cast nets									15	90
Lines		5		25		10				2
Tongs			20	120					12	84
Shore and accessory property		15,500		18,650		1,650		7,000		4,000
Cash capital		5,000		8,500		800		2,400		900
Total		21,835		56,800		4,565		12,562		5,896

Designation.	Volusia.		Brevard.		Dade.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels transporting			1	$400			2	$2,400
Tonnage			8.09				16.87	
Outfit				80				1,930
Boats	10	$250	126	6,935	18	$2,190	527	19,800
Apparatus of capture—shore fisheries:								
Seines	2	190	1	100	1	165	44	3,735
Gill nets			203	8,220	23	925	487	28,547
Cast nets	15	75					30	165
Turtle nets	2	30	31	290	4	60	37	380
Lines		3				1		46
Tongs			19	133			51	337
Shore and accessory property		700		16,115		1,100		64,715
Cash capital		400		10,100		1,000		29,100
Total		1,648		42,373		5,441		151,155

Table showing by counties and species the yield of the fisheries of the eastern coast of Florida.

Species.	Nassau.		Duval.		Putnam.		Orange.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives, fresh			14, 500	$210			19, 413	$194
Alowives, salted			5, 000	125				
Black bass			8, 000	320			34, 116	1, 564
Cat-fish			104, 000	3, 120	20, 000	$600		
Channel bass or red-fish	4, 106	$82	44, 570	891				
Drum	12, 000	125						
Mullet, fresh			288, 000	2, 280				
Mullet, salted			22, 400	596				
Shad	12, 000	450	731, 480	30, 747	101, 600	3 200	152, 600	6, 575
Spots and croakers	5, 113	250	5, 020	150			10, 000	250
Squeteague	12, 000	360			100, 000	3, 390		
Sun-fish			15, 760	472	5, 000	250	205, 116	5, 505
Whiting	5, 000	250						
Other fish	6, 478	300	38, 590	1, 158			10, 000	250
Oysters	318, 500	4, 137	63, 000	3, 600				
Crabs	1, 300	80	1, 200	30				
Shrimp	20, 000	750	16, 600	662				
Terrapins	9, 000	1, 200	1, 350	225				
Total	405, 497	7, 984	1, 359, 470	44, 586	226, 600	7, 440	431, 245	14, 338

Species.	St. John.		Volusia.		Brevard.		Dade.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Black bass					10, 400	$300		
Blue-fish	2, 000	$60	2, 300	$58	36, 307	787	5, 814	$216
Channel bass or red-fish	36, 943	563	6, 300	126	134, 063	1, 712	9, 800	168
Drum	5, 000	50						
Mullet, fresh	134, 500	1, 345	123, 100	4, 013	1, 791, 157	13, 479	5, 200	39
Mullet, salted			49, 000	980				
Pompano	20, 000	800	14, 360	1, 005	138, 284	9, 866	23, 700	1, 422
Sea bass	5, 570	210						
Shad			13, 500	600				
Sheepshead	14, 137	213	6, 700	134	300, 727	4, 511	68, 600	1, 050
Spanish mackerel	2, 000	80			450	28	1, 000	52
Spots and croakers	3, 000	122						
Squeteague	36, 000	1, 260	36, 000	1, 160	324, 370	6, 487	8, 000	160
Sun-fish					23, 113	600		
Whiting	3, 000	115						
Other fish	24, 510	945	13, 240	367	5, 022	151	5, 500	185
Oysters	35, 000	2, 500			42, 505	1, 529		
Clams	4, 800	300						
Craw-fish	4, 000	80						
Crabs	1, 200	65						
Shrimp	2, 025	85						
Turtles			1, 600	128	19, 256	1, 443	3, 000	180
Total	333, 685	8, 793	266, 100	8, 571	2, 825, 654	40, 893	130, 614	3, 472

SUMMARY.

Species.	Lbs.	Value.	Species.	Lbs.	Value.
Alewives, fresh	33, 913	$404	Spots and croakers	23, 133	$772
Alwives, salted	5, 000	125	Squeteague	516, 370	12, 817
Black bass	52, 516	2, 184	Sun-fish	248, 989	6, 827
Blue-fish	46, 421	1, 121	Whiting	8, 000	365
Cat-fish	124, 000	3, 720	Other fish	103, 340	3, 356
Channel bass or red-fish	235, 782	3, 542	Oysters	362, 802	11, 766
Drum	17, 000	175	Clams	4, 800	300
Mullet, fresh	2, 341, 957	21, 156	Craw-fish	4, 000	80
Mullet, salted	71, 400	1, 576	Crabs	3, 700	175
Pompano	196, 344	13, 093	Shrimp	38, 625	1, 497
Sea bass	5, 570	210	Turtles	23, 856	1, 751
Shad	1, 011, 180	41, 572	Terrapins	10, 350	1, 425
Sheepshead	390, 164	5, 908			
Spanish mackerel	3, 450	160	Total	5, 882, 662	136, 077

THE YIELD BY DIFFERENT FORMS OF APPARATUS.

The gill net is the most efficient form of apparatus in use in eastern Florida, over two-thirds of the total catch being taken by it. Mullet, shad, squeteague, and sheepshead are taken in larger quantities in gill nets than in any of the other forms of apparatus. Seines rank next to gill nets in the amount and value of products. Shad and sun-fish are the principal species taken in seines. Cast nets, which are only used in two counties—St. John and Volusia—give good results. The greater part of their catch is made up of mullets. These nets are in use mainly in waters where other netting is not allowed. Cat-fish is the principal species taken on lines. The other forms of apparatus are turtle nets (these are practically large-meshed gill nets), tongs for oysters, nets for shrimp and terrapin, trot lines for crabs, spears for craw-fish, while clams are generally taken by hand.

Table showing by counties and apparatus the yield of the shore fisheries of the eastern coast of Florida.

Apparatus and species.	Nassau.		Duval.		Putnam.		Orange.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Alewives, fresh	....	....	14, 500	$210	....	....	19, 413	$194
Alewives, salted	....	....	5, 000	125	....	....	....	....
Black bass	....	....	8, 000	320	....	....	34, 116	1, 564
Shad	....	....	96, 750	4, 300	4, 500	$200	145, 600	6, 309
Spots and croakers	....	....	5, 020	150	....	....	10, 000	250
Sun-fish	....	....	15, 760	472	5, 000	250	205, 116	5, 505
Other fish	....	....	15, 000	450	....	....	10, 000	250
Total	....	....	160, 030	6, 027	9, 500	450	424, 245	14, 072
Gill nets:								
Channel bass or red-fish	....	....	44, 570	891	....	....	....	....
Mullet, fresh	....	....	288, 000	2, 280	....	....	....	....
Mullet, salted	....	....	22, 400	596	....	....	....	....
Shad	12, 000	$450	634, 730	26, 447	97, 100	3, 000	7, 000	266
Squeteague	3, 100	93	....	....	100, 000	3, 390	....	....
Other fish	3, 478	150	23, 590	708	....	....	....	....
Total	18, 578	693	1, 013, 290	30, 922	197, 100	6, 390	7, 000	266
Lines:								
Catfish	....	....	104, 000	3, 120	20, 000	600	....	....
Channel bass or red-fish	4, 106	82	....	....	....	....	....	....
Drum	12, 000	125	....	....	....	....	....	....
Spots and croakers	5, 113	250	....	....	....	....	....	....
Squeteague	8, 900	267	....	....	....	....	....	....
Whiting	5, 000	250	....	....	....	....	....	....
Other fish	3, 000	150	....	....	....	....	....	....
Total	38, 119	1, 124	104, 000	3, 120	20, 000	600	....	....
Miscellaneous:								
Oysters	318, 500	4, 137	63, 000	3, 600	....	....	....	....
Crabs	1, 300	80	1, 200	30	....	....	....	....
Shrimp	20, 000	750	16, 600	662	....	....	....	....
Terrapins	9, 000	1, 200	1, 350	225	....	....	....	....
Total	252, 597	6, 167	82, 150	4, 517	....	....	....	....
Grand total	405, 497	7, 984	1, 359, 470	44, 586	226, 600	7, 440	431, 245	14, 338

Table showing by counties and apparatus the yield of the shore fisheries of the eastern coast of Florida—Continued.

Apparatus and species.	St. John.		Volusia.		Brevard.		Dade.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Seines:								
Black bass					10, 400	$300		
Blue-fish			2, 100	$42	710	14		
Channel bass or red-fish	8, 500	$128			3, 300	50	5, 000	$75
Mullet	8, 500	85					2, 000	15
Pompano	20, 000	800	14, 360	1, 005	3, 100	217	7, 100	426
Shad			13, 500	600				
Sheepshead					12, 000	180	21, 000	315
Spanish mackerel	2, 000	80						
Squeteague	23, 000	805			1, 300	26	1, 500	30
Sun-fish					23, 113	600		
Other fish	7, 080	240	4, 120	110	5, 022	151	5, 500	185
Total	69, 080	2, 138	34, 080	1, 757	58, 945	1, 538	42, 100	1, 046
Gill nets:								
Blue-fish	2, 000	60			35, 597	773	5, 814	216
Channel bass or red-fish	13, 000	195			130, 763	1, 662	3, 400	51
Mullet, fresh	31, 500	315			1, 791, 157	13, 479	3, 200	24
Pompano					135, 184	9, 649	16, 600	996
Sheepshead	5, 900	89			288, 727	4, 331	43, 400	651
Spanish mackerel					450	28	200	12
Squeteague	13, 000	455			323, 070	6, 461	6, 500	130
Other fish	7, 000	275						
Total	72, 400	1, 389			2, 704, 948	36, 383	79, 114	2, 080
Cast nets:								
Blue-fish			200	16				
Channel bass or red-fish	11, 110	167	2, 600	52				
Mullet, fresh	94, 500	945	123, 100	4, 013				
Mullet, salted			49, 000	980				
Sheepshead	2, 100	32	1, 000	20				
Squeteague			36, 000	1, 160				
Other fish	2, 000	80	6, 120	185				
Total	109, 710	1, 224	218, 020	6, 426				
Turtle nets:								
Turtles			1, 600	128	19, 256	1, 443	3, 000	180
Lines:								
Channel bass or red-fish	4, 333	73	3, 700	74			1, 400	42
Drum	5, 000	50						
Sea bass	5, 570	210						
Sheepshead	6, 137	92	5, 700	114			4, 200	84
Spanish mackerel							800	40
Spots and croakers	3, 000	122						
Whiting	3, 000	115						
Other fish	8, 430	350	3, 000	72				
Total	35, 470	1, 012	12, 400	260			6, 400	166
Miscellaneous:								
Oysters	35, 000	2, 500			42, 505	1, 529		
Clams	4, 800	300						
Craw-fish	4, 000	80						
Crabs	1, 200	65						
Shrimp	2, 025	85						
Total	47, 025	3, 030			42, 505	1, 529		
Grand total	333, 685	8, 793	266, 100	8, 571	2, 825, 654	40, 893	130, 614	3, 472

Table showing by counties and apparatus the yield of the shore fisheries of the eastern coast of Florida—Continued.

SUMMARY.

Apparatus and species.	Lbs.	Value.
Seines:		
Alewives, fresh	33,913	$404
Alewives, salted	5,000	125
Black bass	52,516	2,184
Blue-fish	2,810	56
Channel bass or red-fish	16,800	253
Mullet	10,500	100
Pompano	44,560	2,448
Shad	260,350	11,409
Sheepshead	33,000	495
Spanish mackerel	2,000	80
Spots and croakers	15,020	400
Squeteague	25,800	861
Sun-fish	248,989	6,827
Other fish	46,722	1,386
Total	797,980	27,028
Gill nets:		
Blue-fish	43,411	1,049
Channel bass or red-fish	191,733	2,799
Mullet, fresh	2,113,857	16,098
Mullet, salted	22,400	596
Pompano	151,784	10,645
Shad	750,830	30,163
Sheepshead	338,027	5,071
Spanish mackerel	650	40
Squeteague	445,670	10,529
Other fish	34,068	1,133
Total	4,092,430	78,123
Cast nets:		
Blue-fish	200	16
Channel bass or red-fish	13,710	219
Mullet, fresh	217,600	4,958
Cast nets—Continued.		
Mullet, salted	49,000	$980
Sheepshead	3,100	52
Squeteague	36,000	1,160
Other fish	8,120	265
Total	327,730	7,650
Turtle nets:		
Turtles	23,856	1,751
Lines:		
Cat-fish	124,000	3,720
Channel bass	13,539	271
Drum	17,000	175
Sea bass	5,570	210
Sheepshead	16,037	290
Spanish mackerel	800	40
Spots and croakers	8,113	372
Squeteague	8,900	267
Whiting	8,000	365
Other fish	14,430	572
Total	216,389	6,282
Miscellaneous:		
Oysters	362,802	11,766
Clams	4,800	300
Craw-fish	4,000	80
Crabs	3,700	175
Shrimp	38,625	1,497
Terrapins	10,350	1,425
Total	424,277	15,243
Grand total	5,882,662	136,077

NOTES ON THE SHAD FISHERY.

The shad fishery has always been of great interest to the fishermen of this section of Florida, and is particularly so now in view of the decline which has taken place since 1890.

With the exception of a small fishery on the St. Marys River the shad fisheries of the State are confined to the St. Johns River.

Shad make their appearance in the St. Johns River in November, and can be found there from that time until the early part of May. The legal season for the fishery is from December 1 to March 31, although the nets in the lower river are usually taken out about the middle of March, as after that time low prices prevail in the Northern markets. The abundance of shad in each month of the season is indicated by the statement of one buyer below Jacksonville, who purchased all the fish caught in 22 gill nets, which yielded fish as follows:

December	1,073
January	7,557
February	13,633
March (first two weeks)	6,122

The only forms of apparatus in use on the river in this fishery are seines and gill nets. On the lower river the gill nets average about 575 yards in length, 4$\frac{7}{8}$ to 5 inch mesh, and from 40 to 50 meshes in depth. On the upper river these nets average about 300 yards in length, with 5-inch mesh.

The seines used on the river vary greatly, ranging from 200 to 750 yards, with 3-inch or 4-inch mesh.

The principal gill-net grounds are from Mayport, at the mouth, to Jacksonville, a distance of about 20 miles, where the nets are drifted with the tide; and from Bridgeport to Welaka, where the nets are drifted in the narrow reaches where there is some current. A few nets are also operated in other parts of the river.

Up to last season the principal seining grounds were in Lake Harney, but it is said that it does not now pay to operate there, and last season most of the fishermen worked between Sanford and the mouth of the Wikiva River. An important seining-ground is in the river just above Volusia bar. Seining is not permitted in the wide reaches of the river, which are called lakes.

The following table shows the fluctuations in the apparatus and catch of shad for nine years. The only years for which close accuracy can be claimed are the last four, previous data being largely estimated.

Year.	Number of nets.				Number of shad caught.			
	Gill nets.	Seines.	Pound nets.	Total.	Gill nets.	Seines.	Pound nets.	Total.
1873	80			80	250,000			250,000
1876	64			64	160,000			160,000
1877	112			112	280,000			280,000
1878	80			80	200,000			200,000
1880	184	1		185				83,900
1889	166	10		176	493,161	223,000		716,161
1890	191	10	1	202	581,764	289,570	1,500	872,834
1896	171	24		195	331,033	125,248		456,281
1897	168	37		205	227,027	115,711		342,738

The fishery reached its greatest height in 1890, since which time there has been a steady decline. In 1873 the average catch to the gill net was 3,125 shad; in 1876, 1877, and 1878 the average was 2,500; in 1889, 2,971; in 1890, 3,046; in 1896, 1,936, and in 1897, 1,351. While the number of seines increased very rapidly in 1896 and 1897, the catch steadily decreased from that of 1890. During the season of 1896 there were in use on the St. Johns River 171 gill nets and 24 seines, operated by 147 fishermen. The seine catch amounted to 125,248 shad, weighing 255,555 pounds, and was valued at $8,627. The gill-net catch was 331,033 shad, weighing 1,029,001 pounds, valued at $53,297.

During the season of 1897, 168 gill nets and 37 seines were operated by 536 fishermen. The seines took 115,711 shad, weighing 260,347 pounds, valued at $11,409, while the gill nets took 227,027 shad, weighing 746,980 pounds, and valued at $29,713.

A comparison of these two seasons shows that in 1897 there were 3 less gill nets and 13 more seines in use, while the number of fishermen increased 89. The seine catch for this season shows a decrease of 9,537 shad from the previous season, but a gain of 4,792 pounds in weight and $2,782 in value. The gain in weight and most of the gain in value are explained by the fact that fewer small shad, or "skips," were caught last season and more large shad taken. In the gill-net fishery last season there was a falling off of 104,006 shad, 282,021 pounds, and $23,584, making a total falling off on the river from 1896 of 113,543 shad, 277,229 pounds, and $20,802.

On the upper river large numbers of young shad, or "skips," are taken in the seines. These do not average more than 1 pound in weight and are not of much value to the fishermen. In 1896, out of 125,248 shad taken in seines, 53,807 were "skips." The fisheries should not be subjected to this drain on the young fish.

The water hyacinth, a South American floating plant, introduced into the St. Johns River about 1890, and now so abundant as to be a serious impediment to navigation, has already begun to affect the fisheries. There are not many places along the upper St. Johns suitable for the hauling of seines, and when the wind blows toward one of these beaches the fishermen have to suspend operations until the wind changes, as the plants pile up against the bank in such quantities that the shore can not be reached. Gill nets are sometimes caught in the floating masses and extricated with great difficulty. The fisheries below Jacksonville do not suffer on account of this plant, as it is killed by the salt water.

The United States Fish Commission in 1896 planted 4,224,000 shad fry in the river, and in 1897, 2,017,500 fry.

NOTES ON THE OYSTER FISHERY.

Natural oyster-beds are common in eastern Florida. The most important of these are in Cumberland and Nassau sounds and tributaries in Nassau County, the lower St. John's River, Matanzas River, and in the Indian River. There are small beds in Biscayne Bay and in other places, which have not yet been worked commercially.

Since the last general canvass, in 1890, there has been a decrease in the quantity of oysters taken. In 1890, 97,350 bushels, valued at $14,850, were taken, while in 1897, 51,829 bushels, valued at $11,766, were secured, showing a decrease of 45,521 bushels and $3,084 in value.

The greatest decrease since 1890 is shown in Nassau County. In that year 79,500 bushels, valued at $8,175, were taken, while in 1897 the catch was 45,500 bushels, worth $4,137. In 1890 there were two canneries in operation in this county. In 1894 there were four in operation, but there has since been a decline in the supply of oysters, and at present one cannery is in operation, a part of its supply being derived from Georgia waters.

In Duval and Brevard counties the oyster industry has increased since 1890. Brevard County is the most favorably situated as regards the future development of the oyster industry, the Indian River, which is entirely within its limits, having a number of natural oyster beds which have been but slightly drawn upon as yet. If these are properly conserved, a considerable industry could be developed. The allotment of land for private oyster cultivation would most conduce to this end.

AN INQUIRY

INTO THE

FEASIBILITY OF INTRODUCING USEFUL MARINE ANIMALS INTO THE WATERS OF GREAT SALT LAKE.

By H. F. MOORE.

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From time to time persons interested in the development of the resources of Utah have discussed the possibility of introducing into Great Salt Lake fishes and other animals of economic value which normally have their habitats in the salt and brackish waters of the sea and its estuaries. The matter has been called to the attention of the United States Fish Commission at frequent intervals, and some years ago a provisional promise to investigate the lake was made, but until 1898 the opportunity to make the inquiry did not present itself.

It occurred to the writer, while engaged in experiments in growing oysters in claires, that it might be possible to find places near the mouths of the rivers flowing into Great Salt Lake where the influx of fresh water would mitigate the brininess of the lake sufficiently to make the general conditions favorable for the introduction of that valuable mollusk. It was recognized, of course, that the area which, even under the best conditions, would be found to possess the requisite physical characteristics could not be very extensive, and that there was little hope of introducing marine fishes, for Great Salt Lake holds salt water of a density which could not be endured by ordinary marine organisms. Where fresh water flows into the lake from the rivers there is formed a narrow zone of a density approaching that of the sea, lying between the fresh water on the one hand and the salt on the other. This zone occurs only near the mouths of streams, and its limits are so circumscribed as to allow but small latitude for the wanderings of fish and other marine organisms possessing active powers of locomotion, and they would be restricted therefore in the exercise of one of their most important functions, and would be in constant danger of wandering into the surrounding water where the conditions would be fatal. The oyster, on the other hand, is a sessile organism, and, if its immediate surroundings be favorable, a restricted area does not prohibit oyster culture of a certain character, except in so much as it correspondingly restricts the number of oysters which it is possible to raise.

Influenced by these considerations, inquiry was made of persons interested in the matter and resident in the vicinity of the lake, and the replies indicated that there were certain places near the mouths of the rivers where one might expect to find the fresh and salt waters blending in a manner which would satisfy the requirements so far as the density was concerned.

Preliminary experiments had shown that diatoms, which constitute the chief food of the oyster, would grow in Salt Lake water when it was reduced in density within the limits in which the oyster would thrive, and it was believed that they would be actually found in the lake under the same density conditions. This assumption was afterwards verified by the investigation. Sufficient warrant was then apparent for an investigation which, if it had no other results, would at least set at rest any future agitation and uncertainty concerning the matter.

The scope of the inquiry was enlarged to embrace the question of the feasibility of introducing not only the oyster, but also crabs and fishes, although probably nobody in the Commission had any expectation of favorable results from either, and perhaps with the exception of the writer none had much hope of a favorable report concerning the oyster.

From its configuration, and from the information which it was possible to acquire by correspondence, Bear River Bay was selected as the first and principal point for investigation, although, after the unfavorable result of the examination there, inquiry was directed to all other places which offered any promise of success. About three weeks were consumed in the inquiry.

In order to make the results intelligible considerable attention is given in the report to a résumé of the hydrographic, physical, and chemical features of the lake and its drainage systems, as it is upon these, rather than upon the purely biological conditions, that the unfavorable character of the conclusions is based.

GREAT SALT LAKE DRAINAGE BASIN.

The drainage basin of Great Salt Lake comprises about 54,000 square miles, principally in northern and northwestern Utah, but including also a small part of southwestern Wyoming and southeastern Idaho. Practically all of the water discharged by streams into the lake is derived from the eastern part of its drainage basin, where the high peaks of the Wasatch and Uinta ranges interrupt and cool the moisture-laden winds and cause them to deposit their aqueous contents in the form of snow and rain. During the winter great stores of snow accumulate in the mountains to be released during the spring months, and in some of the higher and more sheltered ravines snow banks persist throughout the year. Owing to the late melting of the snows in the mountains the rivers discharge their maximum amount of water late in spring and the cumulative effect is to bring the lake to its maximum elevation late in June.

There are three principal drainage systems—the Bear, the Weber, and the Jordan—all of which enter the lake on the east side. In addition, there are a number of small streams and creeks, which, in the main, are more heavily charged than the rivers with saline materials. Most of them flow from the Oquirrh and Promontory ranges. On the western side of the lake there are no high mountains, and as there is nothing therefore to abstract the moisture from the winds there is practically no drainage into the lake from the westward.

The land on the west side is, in general, a desert with scattered short mountain ranges of small altitude and the isolated, partly buried buttes and peaks commonly called "lost mountains."

BEAR RIVER.

Bear River rises in the northern part of Utah in a number of small streams which spring from the east slope of the Wasatch Mountains and the north slope of the Uinta Mountains, at an altitude of about 10,000 feet. The course of the stream is at first northerly, several times crossing and recrossing the boundary line between Utah and Wyoming and receiving on its way many small streams from mountain ravines. At Border Station the Bear River finally leaves Wyoming, and entering Idaho is deflected to the northwest as far as Soda Springs, where it circles the end of the Bear River Mountains and takes a southerly course.

Bear Lake, about 22 miles long by 7 miles wide, lies across the boundary line between Idaho and Utah, being contained in about equal parts in each State. North of the lake is an extensive marsh, separated from it by a long, low ridge of sand thrown up by the waves to a height of from 2 to 5 feet above the water level, and pierced in two places by narrow passages, through which the water flows from the lake into the marsh, or from the marsh into the lake, depending upon the relative level of each.

Bear River flows through the northern and eastern part of the marsh, flooding it in times of high water and draining it during dry seasons, and from the conditions stated it follows that the lake to some extent acts as a reservoir, receiving some of the surplus water during flood and relinquishing it again when the river falls. Three million whitefish fry were planted in this lake by the United States Fish Commission in March, 1896, but no evidence has been received that this attempt to introduce the species was successful.

South of Soda Springs the Bear River flows through the fertile Gentile and Cache valleys, the principal tributaries in this region being the Cub River and the several branches of the Logan River on the east and the Malade River on the west bank.

In its lower reaches, below Corinne and the mouth of the Malade River, the river meanders through a low plain used in part for grazing, the width of the stream here measuring between 60 and 75 yards. In the northern part of section 31, township 9 north, range 3 west, it first breaks from its well-defined channel and a large part of its water escapes in two overflows, which spread out into a broad, shallow lake, extending over a large section of what is indicated on the maps as dry land and known to the duck hunters as Bear River Bay.

A few miles lower in its course the river again breaks out in a series of overflows, one of which discharges northward through a shallow lagoon locally called "Section Tom's Bay," and the others flowing southward into South Bay, an equally shallow lake of fresh water lying in the bottom which was covered by the lake during the period of high water between 1865 and 1890. Below the point of efflux of these several "overflows," the main channel of the river, as it existed at the time of the Stansbury survey and the low-water stage of that period, has become almost filled up and reduced to the status of a muddy slough. The course of this channel can still be traced in part by the stumps of the willows which formerly fringed the banks but were killed by the encroaching salt water of the lake and afterwards cut off by the ice that formed on the fresh water above and drifted about under the influence of the wind.

It is evident that during the late period of high water, when the encroachment of the lake upon the land caused the river to discharge farther eastward than is shown upon the map, the silt and sediment brought down by the current were deposited in the old bed and when the lake again subsided the river was forced to seek new channels with the resultant changes in the topography noted above.

Below the upper overflows the country to the northward of the river bank is marshy and overgrown with tules (a species of *Scirpus*), the gathering-place of vast flocks of waterfowl, and below the lower overflows the south side of the river is of the same character. The land map on file at the court-house in Brigham City shows surveyed sections on the north side of the river which are in reality under water (the "Bear River Bay" mentioned above), even at the present low stage of water, while on the south side the recession of the water has exposed a large area of alkali flats and miry clay which was recently part of the lake bed.

The flow of water in Bear River is subject to great seasonal variation, as is shown in the following table recording the discharge as measured at Colinston, Utah, in 1897, according to Professor Fortier:

Date.	Cubic feet per second.	Date.	Cubic feet per second.	Date.	Cubic feet per second.
Jan. 1	1,480	Apr. 20	5,900	Aug. 10	1,100
Jan. 5	1,025	Apr. 25	6,415	Aug. 15	1,100
Jan. 10	1,590	Apr. 30	6,602	Aug. 20	1,025
Jan. 15	1,590	May 5	6,665	Aug. 25	990
Jan. 20	1,275	May 10	7,165	Aug. 30	955
Jan. 25	1,375	May 15	6,665	Sept. 5	1,100
Jan. 30	1,375	May 20	7,295	Sept. 10	1,185
Feb. 5	1,375	May 25	7,665	Sept. 15	1,230
Feb. 10	1,590	May 30	7,295	Sept. 20	1,185
Feb. 15	1,375	June 5	6,540	Sept. 25	1,185
Feb. 20	1,375	June 10	5,500	Sept. 30	1,275
Feb. 25	1,375	June 15	4,805	Oct. 5	1,230
Feb. 28	1,375	June 20	3,990	Oct. 10	1,590
Mar. 5	1,375	June 25	3,035	Oct. 15	1,872
Mar. 10	1,375	June 30	2,570	Oct. 20	1,872
Mar. 15	1,375	July 5	2,445	Oct. 25	1,930
Mar. 20	1,375	July 10	1,930	Oct. 30	1,695
Mar. 25	1,375	July 15	1,590	Dec. 5	1,275
Mar. 30	2,570	July 20	1,375	Dec. 10	1,375
Apr. 5	2,570	July 25	1,375	Dec. 15	1,590
Apr. 10	3,990	July 30	1,142	Dec. 20	1,695
Apr. 15	5,090	Aug. 5	1,100		

The water of Bear River at the head of the upper overflow is turbid, and ordinarily a large portion of the mud would be precipitated in the shallow lagoons which retard the currents near the river's mouth, a part of it being again taken up and carried into the lake during the spring and summer high water. Curiously, however, these lagoons are not permitted to serve as settling reservoirs during the spring and fall, owing to immense flocks of waterfowl which keep the muddy bottom continually stirred up. During a large part of the year, therefore, the river is discharging a heavy volume of sediment into Bear River Bay, which in its upper end, on this account, has become very shallow, with a bottom composed in the main of soft, deep, sticky mud. In a few places the bottom is firm enough to support oysters on the surface, but in most places a person wading will sink to the knees.

The water in the lagoons near the mouth of the river is quite fresh. An analysis by F. W. Clarke of the water, at Evanston, Wyo., showed the following probable constituents in grams per liter: Calcium carbonate, .1080; magnesium carbonate, .0438; sodium sulphate, .0155; sodium chloride, .0081; silica, .0070. The quantities are so small that the salinometer is not appreciably affected even at the mouth of the river, where it must be supposed that the proportions of the several substances, or some of them, are greater, owing to the leaching out of the salt lands near the lake. It was to this locality that some of the preliminary correspondence pointed as a favorable place for the introduction of the oyster, but the observations just noted make it evident that these waters are entirely without the pale of consideration in this connection. It is probable, however, that the cat-fish might be introduced here with considerable hope of success and a fish supply of some commercial importance to the surrounding country might be thus obtained.

JORDAN RIVER.

Utah Lake, which is the reservoir from which the Jordan derives its main supply, lies in Utah Valley about 40 miles south of Great Salt Lake. It is about 20 miles long with a maximum width of about 8 miles, its dimensions being subject to considerable seasonal and non-periodic variations. It derives its main water supply from streams entering the east side of the lake from the Wasatch Mountains. The largest of these is Provo River, which rises in canyons on the west side of the Uinta Mountains and, breaking through the Wasatch Range, empties into the lake near its middle, in the vicinity of Provo City. Four or five other streams enter it from the east and south, but they are very small, except during April, May, and June. Fed as it is by a fluctuating supply, the lake level undergoes great oscillations, in its turn affecting the discharge of the Jordan, through which all of the surplus water is carried.

The Jordan leaves Utah Lake at its northern end and soon after passes through a gap in the Traverse Mountains at a point where the discharge from a former greater Utah Lake has cut a deep channel, now characterized by rapids. North of the "Narrows" the Jordan receives a number of small tributaries from the canyons of the Wasatch, but a large part of the water of these streams is utilized for irrigation purposes in Salt Lake Valley and furnishes the water supply of Salt Lake City. In its lower part the river runs through an alkali plain. It flows in a well-defined channel until it reaches a point west of Woods Cross, where the channel forks, the western fork almost immediately breaking up into a series of tortuous channels in a marsh. The eastern branch maintains its integrity to a greater extent, but the whole country below the forks forms a marshy delta, cut up by sloughs and lagoons, with a bottom of soft mud supporting a growth of sedges and tules. In many of the lagoons a dense growth of watercress forms a mattress rising sometimes as much as 2 feet above the water level.

The only really firm ground in the delta is formed by a sandy tract, extending perhaps a mile parallel to the east channel, and destitute of vegetation. This is stated to be the filled channel of the river before the late high-water level in the lake.

As at Bear River, the water in the lagoons is practically fresh, a sample taken in the east channel of the river where it enters the lake having a density of 1.0008. The following is the probable composition of the solid matter in solution in the water at the source of the river in Utah Lake, as deduced from the analyses made by F. W. Clarke, in 1883, the figures representing grams to the liter of water: Calcium carbonate, .0038; magnesium carbonate, .0644; sodium carbonate, .0204; calcium sulphate, .1849; sodium chloride, .0204; silica, .0100. It will be noticed that this water differs from that in Bear River in the much smaller content of calcium carbonate, in the presence of a large proportional amount of calcium sulphate and some sodium carbonate, and in the absence of sodium sulphate. This represents the main supply of the Jordan, but the composition is to some extent modified by the influx of the several creeks entering the river below Utah Lake, and by the mineral matter leached out of the alkali lands. Its salinity, however, is so low that there is no possibility whatever of introducing marine species, such as crabs, in the lagoons of the delta, and there is no necessity, therefore, to consider the probable physiological effects of the several mineral constituents upon fishes and other aquatic life.

Unfortunately the Jordan River has not been systematically gauged, and its annual oscillation can not be shown, as in the case of Bear and Weber rivers. It undergoes the same variation, however, discharging most water in July and least in early spring. At its maximum it carries much less than the Bear, and at its minimum it has about three-fourths of the flow of that river, its annual oscillation being, therefore, less than in the case of either of the other rivers considered in this report, owing to the fact that its flow is regulated by the reservoir function of Utah Lake. The lake off the mouth of the Jordan River may therefore be considered to have a smaller annual fluctuation in density, so far as the influx of fresh water is concerned, than it has in corresponding relation to either the Bear or the Weber; that is, leaving out of consideration the effects of the wind in directing the flow of the strongly saline water of the lake, there is less liability of a fatal variation due to the influx of fresh water from the river. If, we will say, oysters were put down during the low-water stage of the river, near the outer limit marking the location of the maximum density in which they will live, it is not certain that the water during the flood season would become freshened below the minimum density in which they thrive. But taking into consideration the fact that the outer limits of the zone of favorable density move landward during the prevalence of north winds, owing to the encroachments of the briny water of the lake, it is evident that in so locating our plant as to prevent the one catastrophe we would invite another.

As compared with the Bear River the waters at the mouth of the Jordan are clear and the mud of the lake bottom is harder and not so deep. This is doubtless owing in part to the deposit of a larger proportion of the suspended matter in the sluggish water of the lagoons and sloughs, where it is not stirred up by the waterfowl, as on the Bear River. In many places the bottom on the alluvial fan is quite hard, and covered with a vegetable felting or carpet composed largely of diatoms. This is especially the case in the shoaler, fresher water, to which places, however, the saline waters find frequent access. The zone of mixed water is here broader than at the mouth of the Bear or Weber.

WEBER RIVER.

The Weber River rises in the high ridges of the western part of the Uinta Mountains, between the sources of the Bear River on the north and the Provo River on the south. It receives a number of tributaries on both banks, but none of considerable importance except the Ogden River, which joins it at Ogden.

Below Ogden the Weber runs through low land, and eventually breaks into two branches, one of which flows to the north, the other to the south. The northern branch divides and subdivides, part of it being lost in the swampy flats and part flowing into a shallow bay (not shown on the map), which is connected with the lake north of Mud Island. This bay, which was formed during the recent subsidence of the lake, is about 2 miles long and ¾ mile wide, with an average depth of about 4 inches. The southern branch enters the lake 4 or 5 miles west of Hooper, opposite Fremont Island. The channel remains undivided to its mouth, and it carries practically the whole discharge of the river except during the spring floods. In October, 1898, the north channel was almost dry.

The Weber River is subject to greater and more sudden fluctuations than either the Bear or Jordan, doubtless on account of the absence of natural storage reservoirs, such as are found in the lakes on the other rivers.

The discharge as measured at Devil's Gate, Weber Canyon, during 1897 was as follows:

Date.	Cubic feet per second.	Date.	Cubic feet per second.	Date.	Cubic feet per second.
Jan. 1	360	May 5	5,397	Sept. 5	185
Jan. 5	360	May 10	4,557	Sept. 10	220
Jan. 10	360	May 15	4,820	Sept. 15	220
Jan. 15	360	May 20	4,715	Sept. 20	270
Jan. 20	310	May 25	4,400	Sept. 25	270
Jan. 25	360	May 30	3,340	Sept. 30	415
Jan. 30	360	June 5	2,590	Oct. 5	545
Feb. 5	360	June 10	1,615	Oct. 10	545
Feb. 10	360	June 15	1,275	Oct. 15	545
Feb. 15	360	June 20	1,175	Oct. 20	545
Feb. 20	360	June 25	785	Oct. 25	545
Feb. 25	310	June 30	335	Oct. 30	545
Feb. 28	310	July 5	220	Nov. 5	480
Mar. 5	310	July 10	220	Nov. 10	480
Mar. 10	415	July 15	220	Nov. 15	480
Mar. 15	360	July 20	185	Nov. 20	480
Mar. 20	360	July 25	185	Nov. 25	415
Mar. 25	785	July 30	185	Nov. 30	415
Mar. 30	785	Aug. 5	185	Dec. 5	415
Apr. 5	1,275	Aug. 10	185	Dec. 10	415
Apr. 10	2,275	Aug. 15	185	Dec. 15	415
Apr. 15	2,910	Aug. 20	185	Dec. 20	415
Apr. 20	4,610	Aug. 25	185	Dec. 25	415
Apr. 25	2,640	Aug. 30	185	Dec. 30	415
Apr. 30	4,610				

A volume of water, very considerable as compared with the ordinary flow of the stream, is diverted from the Weber River for purposes of irrigation.

The main channel discharges over a well-defined fan, which extends about 1½ miles from the present shore line. The shores here are formed by a part of the delta laid down during a higher stage of water than now obtains, and the slope is so gradual that the position of the water line fluctuates widely under the influence of the winds and slight changes in the lake level, a rise of an inch changing the position of the shore line north of the river mouth by several hundred yards.

The water on the fan is practically fresh, but at its edge, where the slope becomes more abrupt, the density falls rapidly. On October 18, 1898, about 1½ miles from shore the salinometer registered a density of 1.0315 in a depth of 1 foot; 50 yards nearer the shore the depth had decreased to 7 inches and the density to 1.0040; 50 yards farther in the depth was 5 inches and the density 1.0020, and 100 yards farther the readings were 4 inches and 1.0005, respectively. The water on the fan was clear, but the salt water around the rim had a milky appearance, probably due to the imperfect solution of its saline contents on account of its low temperature, 12° C. (53.6° F.). The bottom on the delta is generally firm and there is an abundant growth of diatoms. Both of these conditions are favorable to the growth of oysters, but the density is fatal and the extreme shallowness objectionable.

BRACKISH SPRINGS.

After the completion of the examination of the lake at the mouths of the main streams flowing into it, it appeared desirable to investigate some of the numerous brackish springs which are characteristic of the country bordering on Great Salt Lake. It was thought that perhaps by utilizing some of the ponds to which they give rise, or by constructing artificial ponds or claires and regulating the flow of water, the density might be so regulated as to secure the requisite conditions. The springs selected for examination were those flowing from the end of the Oquirrh Mountains south of Saltaire and Garfield Beach.

At Chambers Station there is a group of springs on the property of Mr. Anderson, most of them in the bottom of a small pond in which carp and trout have been introduced by the owner, both being said to thrive. A small spring on the margin of the pond had a density of 1.0003; about 50 yards below the discharge of the pond the density was 1.0012; about 250 yards below it was 1.0018, and about half a mile from the pond it had risen to 1.0019, all densities being corrected to 15° C. Near the place at which the last reading was taken a sluggish spring rises from a deep hole with abrupt margins, the density there being 1.0014. In the stream forming the discharge of the pond confervoid algæ in abundance and several schools of small fish were seen. There is a copious discharge of water from the pond, and the flow, which was not measured, is said to vary but little with the seasons. In the lower course of this stream the land becomes somewhat boggy and much of the water is lost through evaporation over the increased surface thus produced.

Two springs were next examined on the property of Mr. Spencer, several miles west of Chambers station, on the road to Black Rock. They rise between the highway and the railroad. The east spring has a density of 1.0003 at its source, and the west spring 1.0013 at the railroad and 1.0015 about 200 yards below. Both of them flow through boggy ground, and their courses are much choked with algæ and watercress.

Near Black Rock are two springs just south of the highway and about half a mile from the lake. The eastern one, which is the larger, has a density of 1.0046, the most saline spring examined. The flow from this spring exceeds that of any others except that at Chambers station. The second spring, about one-fourth mile west of the one just described, is much smaller and has a density of 1.0018.

Oysters will live in water of a density or specific gravity between 1.002 and about 1.0024, but near the limits mentioned they are inferior in quality and of but little value as food. In water of low density they become poor, flabby, and tasteless, while near the upper limits of their adaptability they become small and almost worthless, as may be seen in the mangrove oysters in certain parts of the South and in some of the West Indies. To raise oysters of the best quality it is necessary to have the water of such salinity as will give a specific gravity of between 1.010 and 1.020.

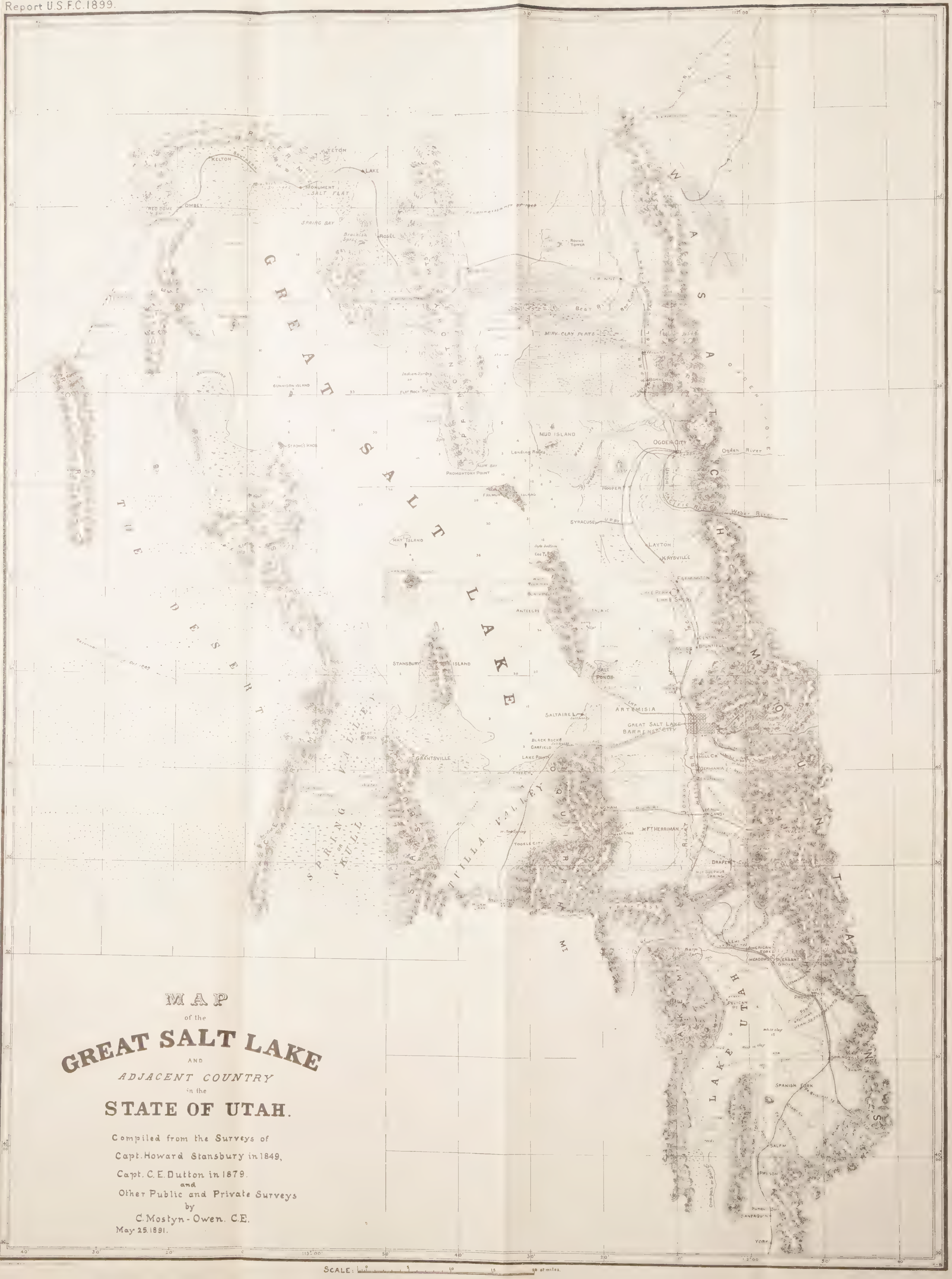
It will be observed that none of the springs examined has a density within the limits which experience has indicated as most favorable for the production of sapid oysters, but the eastern or larger spring at Black Rock is saline enough to support adult oysters and to admit of their breeding. In all probability, therefore, provided that the chemical constituents of the water were not such as to prove injurious, self-sustaining oyster beds might be established in the waters flowing from this spring, but their quality would not be sufficiently good to warrant the attempt.

If, however, this water were conducted into shallow ponds the evaporation would tend to raise the density. The evaporation at Salt Lake City is about 75 inches per annum and the rainfall about 50 inches, so that the net loss in fresh water is about 2 feet per year. A pond 2½ feet deep and without an outlet would by solar evaporation alone have its density raised to within the desired limits in less than two years, provided sufficient water from the spring be introduced from time to time to replace that lost by evaporation. If no water be allowed to escape from the pond save by evaporation, there will be speedily reproduced in miniature the conditions prevailing in Great Salt Lake and the density would soon rise to a degree fatal to the oyster. After the pond has reached the desired salinity, however, it may be maintained within the proper limits by regulation of the intake and outlet sluices, the inflowing stream of lower density tending to reduce the salinity of the pond by replacing the denser water which flows from the outlet. By a nice adjustment of the influent and effluent streams it would be possible to regulate the density within comparatively narrow limits with a minimum of personal attention on the part of the operator. Two conditions are imposed by the problem: (*a*) The inflow must equal the amount of water lost by evaporation, plus the quantity flowing out of the pond, minus that which is gained from the rainfall in the pond; (*b*) the smaller amount of dense water flowing out must contain the same amount of salt as the larger amount of less dense water flowing in.

GREAT SALT LAKE.

Great Salt Lake is situated in the northwestern part of Utah, west of the Wasatch Mountains, being embraced within the limits of Box Elder, Weber, Salt Lake, and Toelle counties. Its length is about 80 miles, lying in a northwest-southeast direction, and its greatest width is about 35 miles. In 1869 it had, according to King's survey, an area of 2,170 square miles, this being the maximum area within historic times. At the present time it has decreased to approximately the dimensions shown on the Stansbury map of 1850, when it had an area of about 1,750 square miles, 20 per cent less than in 1869. Its maximum depth, according to Stansbury, was 36 feet; and the King survey, made at the time of highest water within recent years, reports a depth of 49 feet. The shrinkage since 1869 has been approximately 10 feet, so that the maximum depth is not far from 38 or 39 feet at present. The deepest water is west of the Promontory, the water east of that peninsula and Antelope Island being comparatively shoal and gradually becoming shoaler by the deposit of silt from the rivers.

The principal islands are Fremont and Antelope, in line between the


GREAT SALT LAKE
THE DESERT
WASATCH MOUNTAINS
UINTAH MTS
PROMONTORY MTS
KELTON
TETON
LAKE
MONUMENT
SALT FLAT
RED DOME
OMBLEY
SPRING BAY
ROSEL
GUNNISON ISLAND
STRONGS KNOB
FLAT ROCK PT
PROMONTORY POINT
MUD ISLAND
Landing Rocks
HAT ISLAND
ANTELOPE
STANSBURY ISLAND
MIRY CLAY FLATS
Bear R.
CORINNE
BONNEVILLE
OGDEN CITY
Ogden River
HOOPER
UNION PACIFIC R.R.
Weber River
SYRACUSE
LAYTON
KAYSVILLE
FARMINGTON
BOUNTIFUL
SALT PONDS
SALTAIRE
ARTEMISIA
GREAT SALT LAKE CITY
BLACK ROCK
GARFIELD
LAKE POINT
GRANTSVILLE
PILOT ROCK
SKULL VALLEY
SPRING OR SKULL VALLEY
STANSBURY MTS
TUILLA VALLEY
TOOELE CITY
OQUIRRH MTS
MILL CR.
GERMANIA
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DRAPER
LEHI
AMERICAN FORK
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SCALE: 0 5 10 15 20 st miles.
113° 00'

MAP

of the

GREAT SALT LAKE

AND

ADJACENT COUNTRY

in the

STATE OF UTAH.

Compiled from the Surveys of
Capt. Howard Stansbury in 1849,
Capt. C. E. Dutton in 1879.
and
Other Public and Private Surveys
by
C. Mostyn-Owen. C.E.
May 25. 1891.

Promontory and Oquirrh mountains, and Carrington and Stansbury islands, forming a similar chain farther west. At the present stage of water Stansbury Island is connected with the shore, and Antelope Island may be reached with little difficulty by fording. Mud Island, usually known as Little Mountain, now rises from the mud flats north of the Weber, but during the recent high-water stage it was an island in fact.

As is well known, Great Salt Lake is a relic of a great fresh-water or brackish sea, Lake Bonneville, the history of which in geologic times is written in the ancient beaches which terrace the mountain sides which formed its shores. This lake had its fluctuations in level, rising and falling probably in correlation to fluctuations in meteorological conditions, but eventually its surface rose until it stood more than a thousand feet above the present level of Great Salt Lake, when it spilled over the crest of an alluvial dam in Red Rock Pass and discharged in a mighty river into the drainage system of the Columbia. The erosive powers of this discharge over the loosely aggregated alluvial matter soon cut a deep channel and the surface of the lake in a short time fell nearly 400 feet, when further erosion was retarded by the hard rock which was then reached, and the size of the effluent stream thereafter was much diminished and became a factor of the excess of precipitation over evaporation in the Bonneville hydrographic basin, the lake level remaining approximately stationary.

At a later period increasing aridity caused an excess of evaporation over precipitation, the lake fell below the level of its outlet, and its succeeding shrinkage in volume was due to a gradual process of desiccation. In its process of drying up the ancient Lake Bonneville was divided into several portions, three of which, of considerable size, exist as lakes of the present day. Of these, Great Salt Lake and Sevier Lake are strongly saline, while Utah Lake, whose drainage basin receives more water than is carried off by evaporation, has become fresh by the continued discharge of its saline matter into Great Salt Lake via the Jordan River.

Historical knowledge of Great Salt Lake dates practically from the time of the Mormon immigration into the valley, although it had been visited previously by adventurous travelers and trappers. At the time of the settlement of Salt Lake City, in 1847, the lake was at a lower level than it has since reached, and at the time of the first survey, in 1850, its shores bore evidence that it had been at the existing stage for a long time antecedent. Soon after, however, it began to rise, until in 1857 it stood nearly 4 feet above the level of 1850, its surface being at about 6 feet on the Garfield gauge, established at a later period. By 1860 it had fallen again to its former stage, but in 1864 there began a rapid swelling in volume which carried it to its maximum elevation during historic times, in 1868, when it stood at a height of over 13 feet, as referred to the zero of the Garfield gauge. From the high-water stage then reached the lake has fallen in level, with periods of temporary expansion producing secondary maxima in 1876 and 1887, until in the fall of 1898 it stood at about 2½ feet on the Garfield gauge, or barely a foot above the level of the corresponding season of 1850.

In addition to the nonperiodic oscillation described, there is also an annual fluctuation, due to the temperature and precipitation characteristics of the region, the lake reaching its maximum elevation in June and its minimum in November. This is referred to, as follows, by G. K. Gilbert, in his monograph on Lake Bonneville:

> The cause of this annual variation is at once apparent. The chief accessions of water to the lake are from the melting of snow on the mountains, and this occurs in the spring, occasioning the rise of the water from March to June. Water escapes from the lake only by evaporation, and evaporation is most rapid in the summer. Before the influx from melting snow has ceased it is antagonized by the rapidly increasing evaporation, and as soon as it ceases the surface is quickly lowered. In autumn the rate of evaporation gradually diminishes; in November it barely equals the tribute of the spring-fed streams, and in winter it is overpowered by such aqueous product of mountain storms as is not stored up in snow banks.

There is still another variation affecting the lake level locally, although its average level is not disturbed. Under the influence of strong winds the water is rolled up on the shelving lee shores to a height of several feet above the normal water line, while on the opposite or windward shores there is a corresponding depression. Even with gentle winds, not exceeding 6 or 8 miles per hour in velocity, the writer has known the water to rise an inch or two on the flats forming the eastern shore of the lake between the deltas of the Bear and Weber rivers.

Each of these variations in the lake's level has an important indirect bearing on the subject of the present investigation, the first two affecting the salinity of the lake both generally and locally, while the third has a purely local effect. It is evident that as the water rises, during either an annual or a nonperiodical elevation, the general density of the lake water must decrease, for the increased volume is due to the addition of fresh water, and the total quantity of salt in the lake remains practically, though not absolutely, the same. During a period of subsidence the contrary is true, although some of the saline matter is left by desiccation upon the shores from which the water has receded, part of this being gradually returned to the lake by leaching and part of it being covered and entrapped in the soil. There are no data available to illustrate the effects of the annual oscillation, but the effects of the nonperiodic fluctuation are shown in the following table:

Date.	Sp. gr.	Locality.	Authority.
1850	1.170		L. D. Dale.
1869 (summer)	1.111		O. D. Allen.
1873 (August)	1.102		H. Bassett.
1885 (December)	1.122		J. E. Talmage.
1889 (August)	1.157		Do.
1892 (August)	1.156		E. Waller.
1897 (November)	1.168	Garfield Beach	H. F. Moore.

It will be observed that the foregoing accords in general with the history of the oscillations of the lake, a low density being coincident with a period of high water, and conversely. For a variety of reasons, principally because of the nonconformity in the location and other conditions of the collection of samples, there is not an absolute agreement.

The density of the lake varies in its different parts, being lowest close to the mouths of the rivers and highest near dry shelving shores. In the latter case the density is raised by evaporation in the shallow water until it sometimes reaches the saturation point and the salt is crystallized out and precipitated on the bottom. The process is aided, of course, by the fact that the lake has no appreciable semidiurnal tides, which would tend to produce a more equable distribution of its saline contents. The circulation, however, in the deeper waters removed from the river mouths is probably sufficient to make the density uniform over large areas.

Near the mouths of the rivers the density is largely conditioned by the volume of fresh water brought down by the stream. When the discharge is heavy the dense water of the lake is pushed back and the zone at which the mingling of the fresh and salt waters occurs is farther from shore than when the discharge is light. If the rivers maintained an approximately even flow during the year this fact could not materially affect the feasibility of introducing marine animals, such as the oyster, for the zone of admixture would remain, other things being constant, at approximately the same position. It happens, however, that the rivers discharging into Great Salt Lake pass through annual oscillations of great magnitude, the maximum and minimum flow of Bear River in 1897, according to the figures published by Professor Fortier, and previously quoted, being about as 15 to 2, and of Weber River in the proportion of about 28 to 1. Data for the Jordan River are not available. It will be seen, therefore, that the fluctuations in the position of what we may call the neutral zone, in which the water has a density of between 1.01 and 1.02, must be very great. Again, during nonperiodic stages of high water—as, for instance, that culminating in 1869—the salt water encroaches on the fresh, and some of the former fresh-water channels of the rivers become converted into more or less saline estuaries.

The annual oscillations would probably affect the local density to a smaller degree, partly because the influence of the higher level of the lake would be masked by the greater inflow of fresh water, as it occurs synchronously, not with the maximum, but still with a high stage of water in the river, and partly by reason of the fact that the rise is not so great as in the nonperiodic oscillations.

Another factor which tends to produce variations in the salinity are the irregular changes in the lake's level, due to the action of the wind. As before stated, winds of even moderate intensity tend to back up the water on flat lee shores, with the result that the denser water moves landward and would inevitably increase the salinity over the areas on which oysters could be planted, and an offshore wind would tend to produce a fall in salinity. In other words, the neutral zone of water, just saline enough to be favorable to oyster life, has no fixed position, but moves shoreward or lakeward in conformity with the direction of the prevailing wind.

The rapidity with which these changes may take place is remarkable as illustrated by the following observations made from an anchored boat in Bear River Bay on October 10, 1898:

Time.	Density.
3.00	1.0210
3.15	1.0244
3.25	1.0274
3.30	1.031+

In the last reading the density was too great to be read with the salinometers used, but it greatly exceeded 1.031.

A few days later, at the mouth of the Jordan, the density was found to change from 1.009 to 1.0141 within 5 minutes. In both cases there was a lake breeze blowing at a velocity estimated to not exceed 8 miles an hour. The salt water crept into the less salt in long tonguelike streaks, the progress of which could be readily distinguished by their color.

In Bear River Bay, at 12.30 o'clock, on October 10, 1898, the density near the north end of "The Knoll" on the promontory was 1.003, at 5.15 o'clock it was 1.011, and at 8 o'clock next morning it had risen to 1.015. The density was, perhaps, higher during the night, as the wind was southerly at nightfall, when the salinity was increasing; but in the morning it had veered to the north, which would tend to blow the salt water lakeward again.

The "neutral zone" appears to be at all times comparatively narrow. This was best illustrated by observations made at the southern mouth of the Weber River, where the fresh water is discharged over an alluvial fan. At the edge of the delta, where its slope begins to increase in its deflection from the horizontal, the water was found to have a density of 1.031 in a depth of 1 foot; 50 yards nearer the shore, where the depth had decreased to 7 inches, the density had fallen to 1.004; 50 yards farther on it was 1.002, and 100 yards farther it was but 1.0005, or practically fresh. The zone of water of a density suitable for the growth of oysters was certainly not more than 25 yards wide, although it extended around the entire rim of the delta.

At the mouth of Bear River the neutral zone was wider, but the distribution of the salinity was so irregular that it is impossible to state its width. A complication was introduced here by the fact that the density was undergoing rapid change from the effect of the wind, as has been already set forth.

The observations made are recorded in the following table:

Station.	Location.	Density.
1	50 yards off north point of knoll on promontory.	1.003
2	1,000 yards south	1.010
3	1,500 yards south	1.005
4	1,800 yards south	1.012
5	2,100 yards south	1.027
6	2,400 yards south	∞ *
7	500 yards east	1.027
8	1,000 yards east	1.022
9	1,300 yards east	∞
10	1,500 yards east	∞
11	400 yards north	∞
12	900 yards north	∞
13	1,400 yards north	1.0255
14	1,700 yards north	1.0215
15	1,900 yards north	1.210
16	2,100 yards north	∞
17	2,200 yards north (point of knoll S. of W.)	∞
18	2,500 yards north	∞
19	100 yards east	1.021
19	Same (15 m. later)	1.024
19	Same (10 m. later)	1.027
19	Same (5 m. later)	1.031+
20	300 yards east	∞
21	400 yards west	1.016
22	800 yards west	∞
23	1,200 yards west	∞
24	1,400 yards west	∞
25	1,600 yards west	∞
1	2,100 yards west	1.011

* Much over 1.031, the highest reading on salinometers used.

On the line returning from the promontory to Bear River the density fell from 1.0165 at the promontory to 1.0015 half a mile east-northeast. The entire area of Bear River Bay north of this point, as determined by the investigation, is practically fresh. The fresh water apparently extends farther south near the promontory than on the eastern shore, this being accounted for by the western sweep of the main discharge from the river.

At the mouth of the Jordan the full breadth of the "neutral zone" was not ascertained, as a boat was not available for making the observations. The following is the record:

Station.	Location.	Density.	Depth.
			Inches.
No. 1	Off east mouth of river	1.0008	4
2	300 yards from No. 1	1.0020	2
3	450 yards from No. 1	1.0060	6
4	550 yards from No. 1	1.0110	18
5	650 yards from No. 1	1.0090	20
	Same place 5 minutes later	1.0140	20

It was evident from the last reading and from the change observed in the color of the water that the salinity increased rapidly from station 5 lakeward. It is probably an overestimate to state the width of the zone of water having the salinity 1.010 to 1.020 as 250 to 300 yards.

In the cases of the Jordan and the Weber, the distances were estimated by pacing; in Bear River Bay they were based upon distance per stroke traveled by the boat, and checked by reference to the topography of "The Knoll" on the promontory.

The effects of the general narrowness of the neutral zone and its erratic movement under the influence of the several agents discussed are important in their relation to oyster culture. A narrow body of water of a density between 1.010 and 1.020 could be utilized if its position were fixed, or the middle of a wide zone could be used if its maximum oscillation were less than half its width, as in this case the middle belt would not be encroached upon by water either too salt or too fresh. Unfortunately, however, the amplitude of the oscillations is too wide for the maintenance of this condition, as was proved in the case of

Bear River Bay, and inferred from the data obtained and the testimony of informed persons at the mouths of the Weber and the Jordan.

Even should there be found a limited area where the density conditions were such as could be endured by the adult oyster, it would nevertheless be impossible to establish self-sustaining beds—that is, beds annually replenished by young oysters produced thereon. The young oyster is for the first few days of its independent existence a delicate free-swimming organism, about $\frac{1}{90}$ inch in diameter and extremely sensitive to sudden changes in its environment. A density variation of but a few degrees is sufficient to kill it, and the eggs are not even capable of efficient fertilization in water differing very much in salinity from that in which the parents lived. It can be readily seen that with an organism so fatally responsive to changes of environment there could be practically no hope of securing a successful set of young oysters, and the bed could only be maintained by annual importations from the seacoast.

In Bear River Bay the character of the bottom and the muddiness of the water are also unfavorable to oyster culture. On soft bottom, such as is found over most of this part of the lake, the oyster soon sinks and is stifled, a fate which also befalls it when there is a copious deposit of silt, such as occurs where the muddy water of the river meets the brine of the lake.

At the mouths of the Jordan and Weber rivers the bottom is harder, and the water at the time of the writer's visit was much clearer; but during the high-water stage of spring the rivers deposit large quantities of silt on the delta, just where it would be necessary to plant the oysters if it were attempted at all.

In objection to the introduction of marine organisms into the waters of Great Salt Lake, it was urged that even if the water were diluted to the proper density the composition was so at variance with the composition of sea water that the result would be fatal to marine animals placed in it. The following table shows the relative proportion of the various salts per 100 parts of solid matter in sea water and the water of Great Salt Lake:

Constituents.	Sea water.[*]	Salt Lake water.[†]	Salt Lake water.[‡]
$NaCl$	77.758	83.727	80.5
$MgCl_2$	10.878	6.530	10.3
Na_2SO_4	....	....	5.4
$MgSO_4$	4.737	2.264	....
$CaSO_4$	3.600	3.576	1.4
K_2SO_4	2.465	3.801	2.4
$MgBr_2$	0.217	....	....
$CaCo_3$	0.345	....	....
$LiSO_4$	....	0.070	....
F_2O_3 and Al_2O_3	....	.002	....
SiO_2	....	.008	....
Surplus SO_3	....	.022	....
	100.000	100.000	100.0

[*] Dittmar.

[†] Waller, 1892.

[‡] Talmage, 1889.

From the foregoing table it will be observed that the sea water and Salt Lake water do not differ so greatly in the relative amounts of their solid constituents as is generally supposed. Both are characterized by the great preponderance of common salt. The principal difference is in the character of the sulphates—magnesium and calcium sulphates predominating in sea water, and sodium sulphate being present in Salt Lake water. It will be noticed that sodium sulphate is not regarded as a probable constituent of Salt Lake water by Waller, although it is a well-known fact that during cold weather it is thrown on the shores in quantities available for economic purposes. Sodium carbonate and sodium bicarbonate, the "soda" which produces the alkalinity of many of the lakes of the arid region, are absent in the waters of both the sea and Great Salt Lake. From an inspection of the analyses there appears to be no warrant for the objection that the divergent composition of marine and Salt Lake waters would render the latter ill adapted or inimical to animals accustomed to life in the former, provided that the same density holds in each case. As has been already mentioned, it was found by laboratory experiment that marine diatoms would flourish in properly diluted Salt Lake water.

A partial experiment with fishes was made with a small quantity of Salt Lake water shipped to Washington through the kindness of a correspondent. The quantity was too small for a conclusive trial, but so far as it went the result was unfavorable, the fish showing distress after a short stay in the water, and dying within two days of the time of their introduction. The density of Salt Lake water was reduced to the same degree (1.016) as the salt water in the aquaria in which the fish had been living, so as to minimize the shock resulting from the transfer from one jar to the other.

The salts in Great Salt Lake are derived from the fresh-water streams and from the fresh and brackish springs flowing into it or discharging in its bottom. The proportion of saline matter in most of the streams is low, although in excess of that usually found in more humid regions, but many springs rising near the rim of the lake are more heavily charged with salts. Some of these have been already discussed and the amount of their salinity indicated, but others of thermal character are much more saline. It is stated that all of the springs arising in the Bonneville beds are brackish. As the lake is without an outlet and all of its surplus water is removed by evaporation, the salts accumulate, and by a process of concentration the waters have reached the condition of a brine. Certain salts of limited solubility and abundant supply have reached the saturation stage and are being precipitated, while others less abundant in the surrounding formations, or more soluble, are still accumulating. The determination of the period of accumulation of salts now in the lake is a complex one, "but we can safely say that the period necessary to charge the lake with common salt by means of the present sources and rate of supply is not more than 25,000 years."*

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*Gilbert, Grove Karl. Lake Bonneville. U. S. Geol. Survey. Monograph I, 1890.

During the writer's visit to Great Salt Lake he several times heard the opinion expressed that the extraction of salts from the lake through the several agencies acting in that direction would in time result in a reduction of its density to a degree which would solve the problem of the introduction of marine forms.

Salts are deposited by the lake principally in three ways: (*a*) by desiccation on the flats covered by the water during stages of elevation; (*b*) by supersaturation, especially at reduced temperatures and low stages; (*c*) by human agencies in the process of salt-making.

In times gone by, when the lake was undergoing rapid shrinkage, quantities of salts, great in the aggregate when we consider the area involved, were left upon and in the soil of the exposed bottom, and even during the comparatively small shrinkage between 1869 and 1898 an appreciable quantity of the lake's saline constituents was left upon the flats. In some cases these materials are so entrapped in the soil that they are not again readily dissolved, but a considerable quantity is, under usual circumstances, returned to the lake by leaching. Common salt is also thrown down in places along shore by the concentration of the water on the shallows by evaporation.

Certain of the saline contents of the water are but sparingly soluble, and the addition of the annual increment from the inflowing streams causes supersaturation and consequent precipitation. This is the case with carbonate of lime, which is thrown down as oölitic sand, and sodium sulphate, which is cast upon the shores in winter when the solvent properties of the water are reduced by its low temperature. The sodium sulphate is largely redissolved when the temperature of the water rises, but there is doubtless a constant loss due to the mechanical mixture of some of it with sand and mud thrown up by the waves. It is sometimes collected along shore in winter for commercial purposes. The amount of saline matter annually lost to the lake through the agencies just discussed can not be estimated, and the opinion as to the future adaptability of the lake to marine organisms was not based upon these agencies, but upon the removal of salt for the use of man. Seeing the great quantities of salt at the salt ponds and not appreciating the vast stores of the lake, the mistake is not unnatural. About 50,000 tons of salts are annually taken from the lake for commercial purposes, but less than 84 per cent, or about 42,000 tons, of this is sodium chloride. Basing the calculation upon Gilbert's estimated accumulation period of 25,000 years, the annual influx of salt from the tributaries of the lake is about 16,000 tons, making the net loss about 26,000 tons. The lake at present holds about 400,000,000 tons of common salt, with a water density of 1.168. A greater density than about 1.020 is not favorable to the oyster, and to reduce the lake to that degree of salinity, its volume remaining unaltered, would necessitate the extraction of about 360,000,000 tons of sodium chloride, and at the present rate of loss this would require a period of nearly 14,000 years. It is not considered that the prospect is such as to require very serious attention at present and the niceties of computation have been neglected.

CONCLUSIONS.

The main body of the lake and a large part of its shores are entirely unfit for the introduction of marine animals of economic value, owing to the high salinity of the water. The proportional constitution of the saline contents of the waters of Great Salt Lake is not vastly different from that of salt water. Great Salt Lake is salt and not alkaline. The physiological effect of its waters upon organisms placed therein probably would not seriously differ from that of sea water were it not for its high density, but to attempt to introduce fishes or other marine animals into water having a specific gravity of 1.168 when they have become adapted by nature to a density of but 1.025 would be an utter waste of effort.

In the Deseret Evening News of October 4, 1892, a scientist of Salt Lake City is quoted as follows:

> The fear that scientists have expressed that fish will not live in the lake is entirely groundless. Of course they would have to be introduced gradually, but that can be successfully done. They can be acclimated by degrees.

It is not stated how the fishes are to be "acclimated by degrees," and the speaker apparently bases his opinion upon his repetition with *Artemia gracilis* of the experiments of Schmankewitsch and others upon the European species *Artemia salina.* It is well known that *Artemia* will live either in brine or fresh water, and in a few generations, and sometimes even in one generation, its form will become so changed by an alteration in density that it is referred to a different genus. Other phyllopods exhibit the same adaptability, but that fact does not furnish sufficient basis for a generalization such as has been quoted.

Similar experiments have not been made with fishes nor with the higher crustacea, although the anadromous species like the shad and the Atlantic salmon experience no ill effects from their periodic migration from sea water into the fresh-water rivers, and vice versa. Some years ago the United States Fish Commission made a plant of shad in the Jordan River, but, with the exception of one or two, the fish were never heard from. It is well known that the oyster will not thrive in water of full oceanic density. No oyster beds are found along our coasts at any distance from sources of fresh or brackish water, and in a density of 1.023, a salinity less than one-seventh that of Great Salt Lake, they are small and of very inferior quality, usually growing between tide marks, sometimes on the shores and often on piles, mangroves, and other fixed bodies to which they attach.

The process of evolution has made the oyster an organism adapted to live in brackish or semisalt water, despite the fact that on our coasts there is ample opportunity for it to acclimate itself "by degrees" to water of full oceanic density, or, on the other hand, for it to extend its habitat up the rivers into fresh water.

The optimum density for oyster-culture is between the specific gravities of 1.010 and 1.020, which range in Great Salt Lake is to be found only near the mouths of rivers which flow into the lake on the eastern shore. An inquiry disclosed that the position of the favorable zone fluctuates under the influence of a variety of causes. During the historic period the level of the lake has undergone extensive oscillations, large areas of land being flooded during periods of high water and conversely the bottom of the lake being laid bare at low-water stages. There is an annual oscillation having the same effect in a minor degree, and the seasonal variation in the discharge of the rivers causes a wide range in the density of the lake near their mouths. Finally there are irregular variations due to the influence of the winds in driving the lake water up on sloping lee shores.

If the conditions as found at any given time were constant there would be no difficulty in introducing such sessile marine organisms as the oyster, but the frequent, almost continuous, fluctuations in the density of the water make the attempt entirely unfeasible. It is not improbable that places could be found where a few adult oysters would survive, but the conditions are such as would inevitably prove fatal to the oyster fry which, as a free-swimming organism, would be certain to be wafted by the currents into water, on the one hand too dense, or on the other too fresh, to be withstood by its delicate and sensitive organization. The adverse and unsuitable conditions would also be sure to be reflected in the inferior condition of such adults as might be able to survive.

The writer is convinced from his examination that neither self-sustaining beds, replenished by their own reproductive activity, nor those maintained by annual importations from the coast, as practiced by the planters in San Francisco Bay, can be introduced in Great Salt Lake with any assurance of commercial success.

None of the brackish springs contain sufficient salt to be utilized in their natural condition, but there are reasons to believe, as has been set forth on page 240, that by excavating ponds their waters might be used. The expense would be great, however, and it is doubtful if they would prove to be commercially successful, even if their experimental feasibility should be proved.

The objections to the planting of fish, oysters, etc., in Great Salt Lake are based on physical rather than biological conditions. There is an abundant food supply, the water teeming with brine shrimps and insect larvæ. The available fish food exceeds in quantity that usually found in the sea, its abundance being largely due, no doubt, to the fact that there are no fish to consume it. The lake is also exceedingly rich in minute plants, especially diatoms which constitute the chief food of the oyster, but from a practical point of view this fact has no value when we are confronted by the absolutely prohibitive physical conditions which the present examination disclosed.

There is much greater probability of attaining valuable results by introducing cat-fish into the fresh sloughs near the mouths of the rivers than by attempting the introduction of marine species into the lake.

A REVIEW

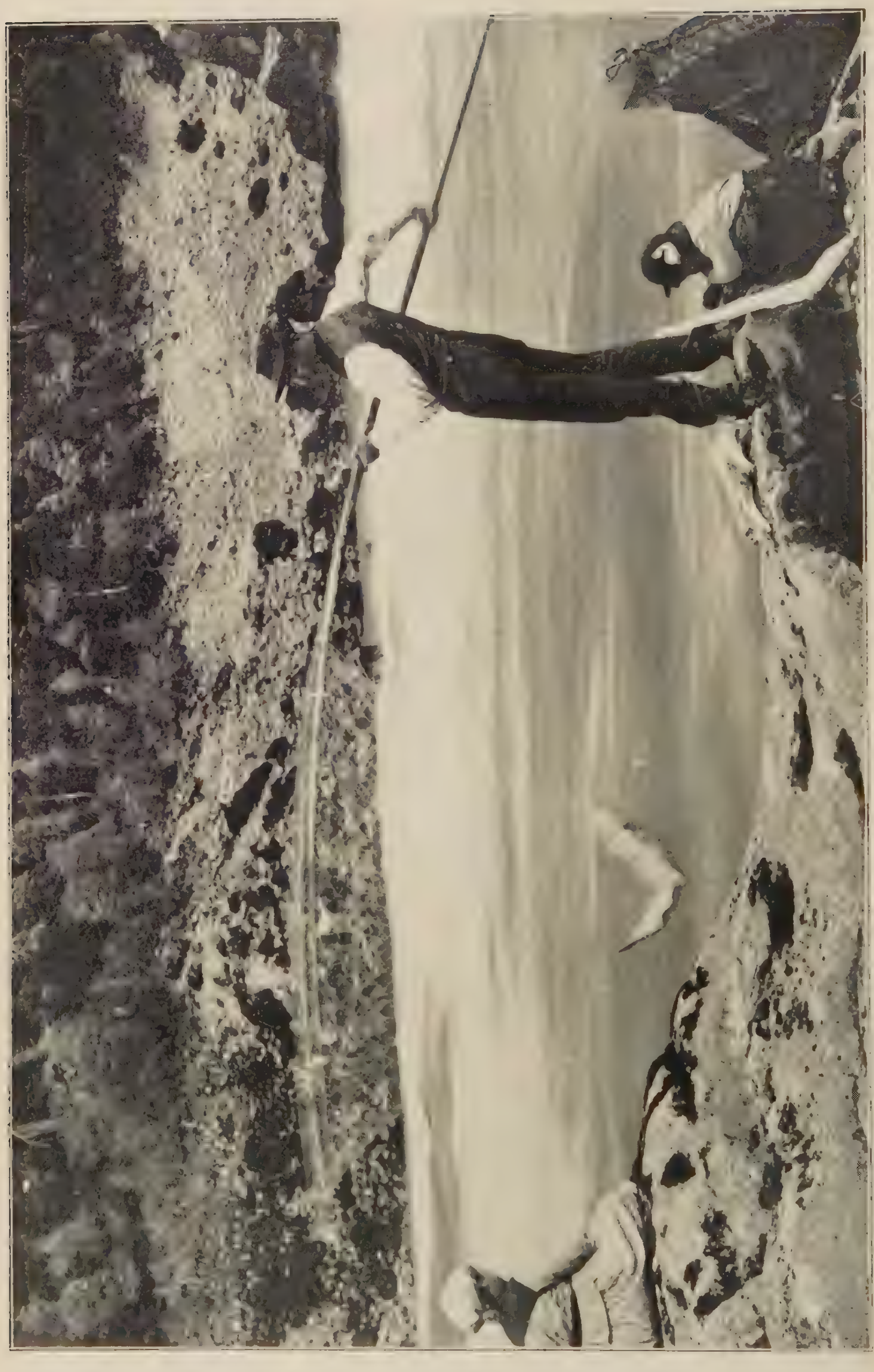
OF THE

FISHERIES IN THE CONTIGUOUS WATERS OF THE STATE OF WASHINGTON AND BRITISH COLUMBIA.

BY

RICHARD RATHBUN,
Assistant Secretary, Smithsonian Institution.

PLATE 8.



DIP-NET FISHING BY INDIANS ON THE FRASER RIVER.

A REVIEW OF THE FISHERIES IN THE CONTIGUOUS WATERS OF THE STATE OF WASHINGTON AND BRITISH COLUMBIA.

By Richard Rathbun,

Assistant Secretary, Smithsonian Institution.

INTRODUCTION.

From 1893 to 1896 the fisheries in the boundary waters between Canada and the United States were made the subject of inquiry by an international commission, composed of Dr. William Wakeham, of Ottawa, as the representative of Great Britain, and the writer acting on behalf of this country. The interesting region at the western terminus of the boundary line, where the fishing industry, though still comparatively new, has already attained a marvelous development, was visited in the summer of 1895, and several weeks were spent in examining its principal features. The results of this investigation, so far as they were directly pertinent to the objects of the commission, were embodied in its report submitted to the two respective governments on December 31, 1896.* Since then the writer has again gone over the voluminous notes made in the field not only by Dr. Wakeham and himself but also by various parties of the United States Fish Commission, including the work of the steamer *Albatross*, and has consulted the long series of reports published by the Canadian Department of Marine and Fisheries. The present paper is based upon the materials derived from these sources, and is limited in scope chiefly to those fishery questions of the region which are of international concern.

The fact most strikingly brought out in the assembling of these data is the great paucity of accurate or detailed information regarding the aquatic products of the region, such as is requisite in providing for their preservation while still permitting them to be utilized without needless interference. With exceptional opportunities for their study, resulting from the favorable conditions of environment, the field is one that would richly repay the inquiries of the naturalist and fishery expert, if properly directed, in the practical benefits they promise. After this explanation it is to be expected that the following pages will prove more serviceable in pointing out lines of profitable investigation than in setting forth the conditions which are actually known to exist, and while attention is called to the great variety of resources, these are enlarged upon only in the directions where their development has already made them prominent. It has also been possible in these same directions to indicate a few plausible means of safeguarding such resources, the suggestions in that regard being made in the full belief that ways can be found for rendering the fisheries as permanent a feature of any region as that of farming.

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* Message from the President of the United States relating to report of joint commissioners relative to the preservation of fisheries in waters contiguous to the United States and Canada. House of Representatives, Fifty-fourth Congress, second session, Doc. No. 315, pp. 178, Washington, Government Printing Office, 1897.

As the circumstances attending the rapid growth of the salmon fishery in the Puget Sound region of Washington since 1895 have not been made the subject of scientific investigation, and as only meager information regarding them has been obtainable, coming often from sources of doubtful authority, it has been impossible to deal with the recent history of the question in other than a very general way. The deductions here presented have, therefore, been chiefly based on the conditions found to exist in 1895, with such additions as seem certainly to be warranted.

PHYSICAL FEATURES.

At the western end of the international boundary line formed by the forty-ninth parallel of north latitude is a nearly landlocked sea, having especially noteworthy characteristics, the most important of which at present is its fishery wealth, shared in somewhat equal proportions by both Canada and the United States. This sea is elongate in shape and extends in a general northwest and southeast direction a distance of over 200 miles. Its southern end penetrates some 50 miles or more into the State of Washington, while its middle and northern parts lie between Vancouver Island, on the west, and the mainland of Washington and British Columbia, on the east. Having nowhere a width of over 35 miles, it is in some places much constricted and contains many islands which occupy the greatest relative area south of the boundary. Two passageways connect it with the ocean, a shorter and broader one, the Strait of Juan de Fuca, opening on the west, and a long series of irregular and mainly narrow channels leading northward.

There is no name, unfortunately, by which this body of water can be designated as a whole. Its northern part, chiefly in British territory, is called the Gulf or Strait of Georgia; the middle portion, largely occupied by the San Juan Islands, appears on the hydrographic charts as Washington Sound, although locally this name is scarcely recognized; while the southern part is known as Puget Sound, a term which is often popularly but incorrectly applied to the entire area within the limits of the State of Washington, exclusive of the Strait of Juan de Fuca.

Prominent characteristics of the sea are its abrupt shores, great depths and relatively low and equable temperature of water. The shore line is exceedingly irregular, being broken by innumerable bays, harbors, and deep inlets, is high and rugged in many parts, and backed by tall mountain ranges and occasional isolated peaks, all of which combine to produce a region of exceeding picturesqueness. The more open areas are the Gulf of Georgia and the waters at the inner end of the Strait of Fuca. The greater part of Puget Sound is divided into long, more or less winding passageways and inlets of medium to very narrow width, which, especially in its southern part, ramify in all directions.

The depth of water exceeds 200 fathoms in a few places, is above 100 fathoms over a wide extent, and seldom falls below 30 or 40 fathoms. This deep water is not alone characteristic of the open areas, but extends through the various channels at the south and reaches close upon the shores. In fact, there is practically no shallow water anywhere, except upon the few shoals and submerged rocks and upon the banks formed about the mouths of rivers by the sediment brought down at flood time. Its temperature seems never to reach 60° F., even in the summer, except in some of the more sheltered bays, the records showing mainly from 53° to 58°, and in the winter it is relatively high as compared with similar latitudes on the Atlantic coast. Under these conditions little is to be feared from local sources of pollution or other generally harmful agencies, and the effects of its rivers, however swollen and muddy during freshets, are for the most part quickly dissipated.

In its ruggedness, its depths, the temperature and purity of its waters, this sea partakes of the characteristics of the adjacent ocean, with which its strong tides maintain a constant interchange. It naturally follows that its fishes are those of the outer coast, which find here only somewhat greater shelter and perhaps a more convenient source of food. To the local fishermen it gives many advantages, convenient grounds, nearby harbors and markets, and those opportunities for fishing which belong especially with a broken sheet of water.

The region, both from its resources and from its natural advantages, is destined to have an important future. Its local products, which have thus far been most developed in the line of the fisheries, are sufficient to secure it great prominence, but its harbor facilities and convenient position with reference to Alaska and the Orient insure its becoming one of the most important commercial districts on the Pacific coast. The surrounding country is, in many sections, being rapidly settled, and while much unwarranted booming has taken place, a number of towns and cities have been established under conditions which make certain their future growth and prosperity. The most important of these in Washington are Seattle and Tacoma, whose commercial activity is already well marked. In British Columbia, Vancouver is the point of transshipment between the Canadian trunk line and the finest fleet of Pacific steamships; New Westminster, on the Fraser, is the headquarters of the salmon fisheries and canning, and Victoria is the principal British seaport. The development of trade and of local resources, not many years now past the stage of infancy, has been phenomenal, and is progressing year by year in an ever-increasing ratio. The recent gold excitement at the north has given a new impetus, but the fisheries, so long as they are preserved, will figure as one of the most valued features of the region.

This landlocked sea has only one large tributary stream, the Fraser River, which belongs entirely in British territory. With a single exception at the north, all other streams which enter from the east belong to the western drainage of the Cascade Range, and are therefore short and correspondingly unimportant. The Fraser is derived from several sources on the western side of the Rocky Mountains in the neighborhood of Yellowhead Pass. Flowing northwest about 190 miles through the deep valley between the Rockies and the Selkirks, it rounds the northern edge of the latter and thence continues southward about 470 miles, when it bends toward the west, completing in that direction the remaining 80 miles of its course. The total length of the Fraser is therefore in the neighborhood of 740 miles. There is one principal affluent, the Thompson, which joins it about 145 miles above its mouth, but of minor tributaries it has very many, ranging from medium size down, which are distributed throughout the system. Belonging with these, as a conspicuous feature of the system, are numerous lakes, generally elongate in shape, placed singly or in chains, which are mostly enlargements of the water-courses and have originated in the obstruction of channels by silt and coarser débris brought down by freshets derived from melting snow on the mountain sides.

The variable nature of the country through which the Fraser flows gives it a great diversity of characteristics, and in its passage through the Coast Range it has produced the celebrated canyon which bears its name. Its surroundings are in many places extremely wild and picturesque, but its lower 80 miles are through a flat, alluvial plain mainly deposited from its own silt, and about 10 miles above its mouth it divides to form a delta through which it reaches the Gulf of Georgia by two principal channels and several lesser ones. This plain affords rich farming land, much of which is under cultivation.

The river is navigable for vessels of ordinary draft a distance of about 80 miles from the sea, and for smaller craft about 60 miles farther. Its current is strong, increasing greatly in the season of freshets, the late spring and early summer, when it overflows its banks to a greater or less extent in the lower levels. This flood condition is chiefly caused by melting snow in the upper and tributary waters, and while varying in extent it seldom causes any appreciable damage, as dikes have been built around the farming lands. There have, however, been occasional extraordinary floods since the region has been settled, the most severe one on record having occurred the last of May and the first of June, 1894, when the river burst all bounds, covering the lowlands and valleys, sweeping away houses, and devastating crops. At this season the fishing is not important and its interests are not materially affected.

The upper limit of tidal influence in the river is in the neighborhood of Sumas, about 55 miles from the mouth, but brackish water is said not to be perceptible much if any above New Westminster. These limitations are for the spring tides during the periods of low water. The freshets counteract the influence of the sea in proportion to their height, and at their maximum carry the fresh water, at least on the surface, as far as the river mouths and into the Gulf of Georgia beyond. The ordinary rise and fall of the tide is about 12 feet at the mouth of the river and 4 or 5 feet at New Westminster.

A marked feature of the freshet season, having an important bearing on the salmon fishery, is the intense clouding of the river by sediment, a fine grayish silt, which remains long in suspension and gives a light slaty color to the water. The deposition of this material is going on continuously throughout the lower level portion of the river, causing shifting bars and banks, which, with their accompaniment of snags, are a source of great annoyance to navigation. But the silt is also carried out beyond the river, where it is adding to the delta formation and building up a wide bank or shoal along the shore, from Point Grey to Point Roberts. This bank is broadest directly in front of the river mouths, of which the principal ones maintain their channels through it into the deeper waters of the Gulf of Georgia.

In the early spring, when the quinnat begin to run, the river is comparatively clear, so that in the daytime the gill nets can be more or less plainly detected by the fish. Later the sediment appears and continues in all its intensity during June and July and into August, when the river begins to clarify. In the opaque water the nets may be used as effectively by daylight as at night, and it is during this season that the great sockeye run takes place, the run on which the canneries mainly depend for their immense pack. Day and night the nets are in the water, not only within the boundaries of the river, but over the outside bank and sometimes beyond its margins where the discolored water extends for several miles in all directions.

Aside from the Fraser there are numerous small rivers belonging to this drainage, of which the greater number and the larger ones are on the east side, taking their rise on the slopes of the Cascade Range. Those north of the Fraser are little known, but they end in large inlets. In Washington the most conspicuous is the Skagit, which is navigable for 60 miles, the other more important ones, beginning at the north, being the Nooksack, Stillaguamish, Snohomish, Dwamish, Puyallup, and Nisqually. These reproduce on a small scale the principal characteristics of the Fraser, the mountain features, the terminal lowlands, the deltas, and the flood season with its turbid waters. On the west side of Puget Sound and along the Strait of Juan de Fuca the streams are still smaller, scarcely more than creeks at the most, the highlands lying closer to the coast and greatly restricting the width of the drainage area. The inner side of Vancouver Island has only two rivers of any moment, the Cowichan and Nanaimo.

FISHERY RESOURCES.

The fishery resources of this region comprise a wide variety of products belonging to both the sea and its tributary fresh waters, many of which are exceedingly abundant and some of high commercial value. As is naturally to be expected, however, in a comparatively new country, still having a small population, the development of these resources has so far been directed mainly toward a few forms especially adapted for export trade.

In this respect the activities have been very marked during recent years and substantial progress has been made in building up a remunerative industry whose permanency may be insured by wise and conservative measures of control, even though its further growth should cause somewhat heavy drafts upon the stock. Still other lines promise good returns for the successful preparation of certain products suited for distant sale, but not until the region shall have become much more thickly settled can its rich fishery opportunities be measured at their full value. There is a host of species requiring near markets to be utilized, whose abundance is sufficient to contribute in due proportion toward the sustenance of an extensive population. As the time when such conditions may be expected to prevail is probably far distant, a large share of these resources must continue long in reserve, a guaranty for the future.

Besides its local resources the region should also have credit for its advantageous position in regard to fishing-grounds farther north along the coast, for which it is the nearest outlet, and with whose development it is sure to become most intimately associated. Its convenient harbors and railroad facilities give it superior facilities for the handling and transshipment of any catch that may be landed on its shore.

The salmon here, as elsewhere along the northwest coast, are the principal objects of fishery, no other group of species comparing with them in the extent and value of the catch. This results from their phenomenal abundance, the perfection to which their preparation has been carried, and, above all, from the firm hold which the canned product has secured in the markets throughout the world. Five species of *Oncorhynchus* and one of *Salmo* are represented, the quinnat, sockeye, silver, humpback, dog, and steelhead salmon. The quinnat is first in quality and, with the steelhead, stands most in favor for the fresh trade. Canners prefer the sockeye, and would use no other species could this one be obtained in sufficient numbers to satisfy their wants The remaining forms, after the common understanding of to-day, should probably be graded in the order given above. The silver salmon is most sought after, but all are utilized for canning—especially on the Washington side—and in other ways. It is a peculiarity of the sockeye or blueback salmon that it enters very few of the rivers of this region, while the other species distribute themselves quite generally and may be taken nearly everywhere.

The halibut should probably be accorded next place after the salmons, not so much on account of the local industry as for the fact that the entire halibut fishery from Cape Flattery to Alaska centers here. The local grounds are mainly distributed through the Strait of Juan de Fuca, and from its inner entrance north to Boundary Bay and south to the mouth of Hoods Canal. The most important nearby bank, however, is in the open sea off Cape Flattery, and other smaller banks lie directly south from there.

With the recent increased demand for halibut, the search for more extensive grounds was carried northward. The nearest one was located off the northern end of Vancouver Island in the vicinity of Cape Scott, but its area is restricted and its capacity relatively small. The most important grounds so far discovered are in Hecate Strait and its vicinity, and it is here that the principal catches have been made in recent years. They consist of numerous banks and patches, generally near the land, on both sides of the strait, the largest extending 60 miles along the northern side of Graham Island from North Island to Rose Point, and thence down the eastern side of Graham Island to the vicinity of White Cliffs. Among the islands of southeastern Alaska and about the southern end of Prince of Wales Island, small quantities of halibut are taken, but the Alaskan region is still open to development as regards this species.

While halibut fishing has always been one of the chief occupations of the Indians in the Strait of Juan de Fuca and the inner sea, the present status of the fishery has been the result of rapid growth dating back only about ten years, or to 1888, when it received its principal stimulus through the advent of two Gloucester vessels, which began fishing on Flattery Bank and in the adjacent region. Although the work of these vessels was not long continued, it gave evidence of abundant resources and led to the opening of markets even as far distant as Boston and Gloucester on the eastern coast, where the western product came directly into competition with that from the great Atlantic fishing-grounds.

In 1890 the total catch from all sources landed in this region amounted to 1,376,800 pounds; in 1891 to 2,124,500 pounds; in 1892 to 2,768,000 pounds, and in 1895 to 4,251,000 pounds. The fleet, which had doubled in four years, consisted in 1895 of 48 boats of 5 to 10 tons measurement, of 10 vessels measuring from 18 to 40 tons, and of 3 steamers. Only the larger vessels and the steamers ventured as far as Cape Scott and the Queen Charlotte Islands. The steam vessels have belonged entirely in British Columbia, their catch being landed at Vancouver, Victoria, and Tacoma, and in 1895 having comprised a very large proportion of the total catch, but their operations are controlled by companies originating in the Eastern States.

Port Townsend was the first headquarters for the halibut fishery, but during the past few years Seattle and Tacoma, with their direct railroad communication, have absorbed nearly the entire business on the part of United States fishermen. Within two years, however, a few small shipments have been made from Fairhaven and New Whatcom. Fishing is carried on most extensively in the winter, and nearly all the catch is landed fresh, only an occasional trip being made for fletched halibut.

The main outlet for the Pacific catch is furnished by the Eastern markets, and is thus controlled by the large Eastern dealers, the shipments being mainly made at seasons when the Atlantic catch is smallest. The cost of transportation across the continent greatly reduces the profit to the catchers, who have to be satisfied with low prices, and who sometimes suffer considerable losses by producing more than the trade can handle. The demand, both at the East and in the interior of the country is said, however, to be constantly increasing, and, if heed be given to the condition of the market at different seasons, there is every reason to suppose that the development of the fishery may go forward steadily and without reverses.

While this fishery is assured a much larger growth, that it will ever approach the Atlantic fishery in extent or stand the same test of time seems improbable. The grounds in the Gulf of Georgia, Puget Sound, and Strait of Fuca, with those off Cape Flattery, have all together only a relatively small capacity, which has already been overtaxed. Along the British Columbian and southern Alaskan coast the continental platform is everywhere narrow, precluding the occurrence of extensive offshore grounds. On the Alaskan banks still farther north, made known through the cod fishermen and the investigations of the United States Fish Commission, halibut have not yet been found in the abundance characteristic of the North Atlantic, though further researches may show the conditions to be more favorable than now appears. But, however uncertain may be the future status of this important branch of fishing, the supply of halibut is undoubtedly sufficient to satisfy the demands of trade for a number of years to come.

While the true cod is of no importance as a local product, yet this region affords convenient shipping facilities in respect to the Alaska banks and will doubtless soon come to dispute with San Francisco for supremacy in their development. Two or more stations for curing and handling this species have already been established in Puget Sound.

Two species of sturgeon occur in these waters, the white sturgeon (*Acipenser transmontanus*) and the green sturgeon (*A. medirostris*), the former being the superior in quality and the only one utilized as food. It is exceedingly abundant, attains a very large size, and is regarded as one of the most important fishery products of the region. While probably ascending most rivers, it is best known on the Fraser, where alone it is now fished for regularly. Elsewhere in British Columbia and in the waters of Washington it forms only an incidental feature of the catch, so far as could be learned, a few finding their way to neighboring markets and some being sent inland. Many are sometimes captured in the salmon traps at Point Roberts, by which a part of the schools pass, apparently on their way to the Fraser River. The season of their movement there, however, seems to be mainly before the traps are set, in May and June, and those obtained are mostly secured during the latter month. The facilities for shipping from that place are so poor that no disposition was made of them until recently, but now a part of the catch is marketed.

Sturgeon are said to be present in the Fraser River at practically all times of the year, but to occur most numerously from midwinter until in June, during which period the fishery is carried on, the largest catches being made in April and May, when the principal run is understood to take place. The fishing-grounds most commonly resorted to are in the main river between New Westminster and Mission, and in Sumas and Harrison lakes. Formerly the sturgeon were taken on the Fraser River solely by the Indians for their own use, and incidentally in the salmon nets. It is only within a few years that a separate fishery has been established, but at present quite a number of persons, whites and Indians, engage in the business, using gill nets and hooks and lines. Both the meat and roe are utilized. The demand for export is increasing, and in the course of a few years it may be expected that the catch will be considerably enlarged.

The herring (*Clupea pallasii*) is one of the most abundant of the exclusively marine species of this coast, but is described as generally inferior in size and quality to the well-known Atlantic form. For this reason probably it is not in much demand for food, a limited quantity only being pickled and smoked, and a few disposed of fresh. It is, however, one of the most important baits of the region, and its value for that purpose may be expected to increase greatly with the development of the sea fisheries. It has also long been utilized for the manufacture of oil, but, while a considerable industry of this character was at one time carried on, the business seems at present to be of slight importance.

The dogfish is another species which has been extensively captured for its oil, and in this case, as with the herring, the fishery has declined, owing to the decreased value of this product, the fish being probably as abundant now as ever.

The eulachon or candle-fish enter the Fraser River in the spring in large numbers for spawning, and although the run continues for only a few weeks, a considerable fishery is carried on. They also resort to other rivers of the region, and may be taken in the salt waters, but the catch in the State of Washington is small. The amount obtained on the Fraser, owing in part to the shortness of the season, is said to be insufficient to meet the demands of even the local markets, which have to depend largely for their supplies upon the more northern rivers of British Columbia, where the species occurs in much greater abundance. Those obtained locally are mostly disposed of fresh, while the salted and smoked fish come mainly from the north. The Indian practice of extracting the fat or oil of the eulachon for domestic use is well known.

The smelt (*Osmerus thaleichthys*) and surf smelt (*Hypomesus pretiosus*) are both plentiful. The former, which measures only about 6 inches in length, is not of much importance for food, but the latter grows to the length of a foot, becomes very fat, and is greatly esteemed. It is already fished for quite extensively, but apparently for local use only.

Both the sardine (*Clupanodon cæruleus*) and the anchovy (*Engraulis mordax*) are inhabitants of these waters. The former, which has attracted considerable attention on the California coast, seems to be present here only during a brief period in the warmer part of the year. The anchovy, however, remains from May to November, is more abundant, occurring in immense schools, and is considered to offer an exceptional opportunity for the preparation of "sardines." A few, which were canned experimentally at Port Townsend, are said to have given great satisfaction. The species is now utilized to some extent both as food and bait.

The beshow or black-cod (*Anoplopoma fimbria*), which has received the high approval of many epicures, and for which an extensive fishery has been predicted by some, occurs in the inland waters, but is more abundant off the outer coast, where it also attains much the larger size. Up to the present time, however, it has been marketed only in small quantities and with no regularity, the catch being partly made in connection with the halibut. The very oily nature of the flesh makes its preparation difficult, and has undoubtedly retarded its introduction.

The cultus-cod (*Ophiodon elongatus*), although not ranking as a high-grade fish, has excellent qualities at certain seasons, is very abundant, and is one of the most common features of the catch among the exclusively salt-water species, being commonly sold in all the local markets. It has a wide range in the North Pacific Ocean, and attains a weight of 60 to 70 pounds. In this region it often goes by the name of cod and ling, to neither of which species, however, is it closely related.

The tomcod (*Microgadus proximus*), a small species, is also in considerable demand locally, and in some places is taken by the fishermen in large numbers.

Of the numerous species of rockfish (*Sebastodes*) which inhabit this region, several are of excellent quality and much esteemed. They are very plentiful, and during the winter are among the principal fishes sold fresh in the local markets. With the increase of population this group is certain to be largely drawn upon. The perches, as some of the viviparous surf fishes are called, are a cheap grade of fish, very common about the shores, and extensively utilized. Among the flounders with which these waters abound are several species of great excellence for food, but the demand for this class of fish is still limited and the catch is small.

The Atlantic shad, which has become well established on the Pacific coast through plants of fry made in the Columbia and Sacramento rivers, has worked its way north into Puget Sound and the Gulf of Georgia, where it is known to enter at least the Fraser and Skagit rivers. Not being specially fished for, information regarding its presence is chiefly based upon specimens caught incidentally and mainly in the salmon nets, which are not well adapted to its capture. It was first noticed in 1888 on the Fraser River, where in 1896 it had become sufficiently abundant to induce the fishery inspector to suggest regulations governing its capture. It seems bound to occupy a prominent place among the food-fishes of this region at no very distant time.

Trout of several varieties are distributed in abundance throughout the fresh waters, an attraction to anglers and a prospective source of profit when the country shall have become more thickly settled.

Aside from the sea otter, now extinct, the marine mammals have never figured prominently among the local fishery products, although some whaling has been carried on. The pelagic fur-seal fishery of the North Pacific Ocean, however, has chiefly centered in the ports of this region, furnishing employment to many hunters and producing a considerable revenue, but its continuance is no longer profitable, in whatever way its future may be settled by negotiations.

Among invertebrates this region is quite rich in edible mollusks and crustaceans. The small native oyster, while occurring in many places, is especially abundant in the shallow extensions of the southern part of Puget Sound, where the beds have recently been given some care and where quite an extensive business has been established. The introduction of the Atlantic species has been agitated and a few small plants have been made, but none of these has yet turned out successfully, so far as can be learned. Of clams there are several species of small to large size, some of which are exceedingly abundant and quite generally distributed. Although constituting an important resource, and esteemed both for food and bait, they have not been very extensively utilized up to the present time. Small quantities have been put up from time to time at one or more of the canneries. A large scallop and a cockle are also conspicuous among the useful mollusks.

Large crabs belonging to the genus *Cancer* are very common, and at certain seasons come up on the shores, in some localities in large numbers. They are in great demand for food and are eagerly sought for, although the total catch is small. The principal if not the only ground where they are now regularly fished for is the shallow bottom along the south shore of the Strait of Juan de Fuca between Dungeness and Port Williams. From there they are sent chiefly to Seattle, Tacoma, and Victoria, but not being fitted to stand a long shipment they are scarcely known at a distance from the coast.

Shrimps and prawns of good quality seem to be plentiful, but they are not much fished for, and little information regarding them could be obtained. The habits of these forms are such as to place them generally outside the ordinary range of observation, so that fishermen may be scarcely aware of their presence, when an active search might disclose them in abundance. At least two species of prawns are brought to market, one of rather large size, the other smaller. They have so far been taken principally about Victoria and in the southern part of Puget Sound, the catch being generally quite inadequate to satisfy the demand. The shrimps are much smaller and are not fished for.

THE SALMONS.

SOCKEYE SALMON.

The sockeye salmon, as the blueback salmon or redfish, the *Oncorhynchus nerka* (Walbaum) of naturalists, is known in this region, is here much the most important of its tribe, being especially in demand for canning purposes, owing to the depth and stability of its color and the firmness of its flesh, although in edible qualities it ranks below the quinnat. It has, moreover, quite regular and well-defined movements, and, beginning to run at a comparatively early date, it affords a considerable fishery so far in advance of the spawning season as to insure an excellent quality of catch. Its size is also in its favor, being quite uniform. In the Fraser River it generally averages about 7 to 8 pounds, though sometimes weighing not over 6 pounds, and occasionally, but rarely, reaching 10 and even 12 pounds.

IN THE SALT WATER.

The sockeye which frequent the Gulf of Georgia and Puget Sound are supposed by the fishermen to enter from the ocean exclusively through the Strait of Juan de Fuca, and such few facts bearing upon the subject as have been collected tend to confirm this view. The species has never been observed in the upper part of the Gulf, and very rarely, if at all, to the north of Point Grey, at the entrance to Burrard Inlet. Some sockeye, which are said to average smaller than those of the Fraser River run, enter the passageway at the northern end of Vancouver Island and ascend the Nimkish River at Alert Bay, and possibly other small rivers in that locality, but none of these fish appear to reach the Gulf of Georgia.

On the outer coast, both to the north and south of the entrance to the Strait of Juan de Fuca, there are still other runs which are also distinguished by the smaller size of the fish, averaging from 4 to 5 pounds apiece. Very little is known regarding their abundance or habits, as the region is sparsely settled, but they are reported to enter only certain rivers, those having lakes in their upper courses. All of these rivers are small, but some of them, on the Vancouver Island coast at least, are apparently resorted to by sufficient quantities of fish for the maintenance of canneries on a small scale. Operations of this character were started in 1895 on Kennedy River, a short clear stream draining a lake of the same name and emptying into the southern end of Clayoquot Sound. The season there is said to correspond with that on the Fraser River, extending from early in July until the last of August, but south of Cape Flattery an earlier period is given for the commencement of the runs, though on somewhat doubtful authority.

All of the evidence collected goes to show that the sockeye entering the Gulf of Georgia and Puget Sound constitute a distinct run, which, approaching from the sea, throws off no schools toward the north or

MIRALTY INLET
ISLAND
AMANO
Pt Townsend
123°
48°

ROUTE OF TH
T RIVER FROM

south, but passes directly and in successive bodies through the Strait of Juan de Fuca toward the spawning-grounds. During their passage up the strait at least the bulk of the fish appears to keep in the deeper water or below the surface until approaching the vicinity of Victoria. At any rate, notwithstanding some statements to the contrary, no reliable evidence has been secured indicating that this species has been seen or captured farther west. In view of the number of fishing and other craft which navigate this channel, and the diligent manner in which the sockeye have been searched for in several localities, it would be strange if their occurrence in any numbers could have been overlooked. Further observations, however, may disprove this conclusion. A run of sockeye is said to enter Port San Juan, opposite Neah Bay, but it evidently belongs to the coastwise schools of smaller fish.

The place where the fish are first known to disclose themselves is at the southeastern corner of Vancouver Island, between Sooke Inlet and Becher Bay, and here the Indians begin their capture, though their fishery is a very small one. This point is regarded rather in the light of a signal station from which the approach of the first as also of the succeeding bodies is heralded to the more important stations farther along their course. News from Becher Bay is anxiously awaited, and its receipt hastens the final preparations for the large and active fishery which immediately follows.

They next appear off Race Rocks, where, however, the tidal currents are so strong that fishing operations have never been successfully carried on.

Having completed their journey through the strait the great bulk of the sockeye turn northward, having the Fraser River as their destination, the number which enters the fresh waters in the State of Washington being relatively small. In their movement north the schools divide or separate, so as to make use of the two principal channels on either side of the San Juan Islands, the Canal de Haro and Rosario Strait, but they avoid the narrower passageways between these islands.

In the Canal de Haro the sockeye have been noticed at several points along the shore of San Juan Island, especially off Kanaka Bay and in the neighborhood of Henry Island, but all attempts at fishing in this section by the whites have so far met with indifferent success. The Indians take them in their reef nets about Stuart Island, and they have been recorded from off Saturna Island. It is probable that the main run works into the Gulf of Georgia through the wider channels between these islands, but it is also certain that a considerable body makes use of Plumper or Active Pass, between Mayne and Galiano islands, which is the most direct route to the Fraser River mouths. It is said, however, that no sockeye pass to the west of Salt Spring or Admiral Island, and the species is understood to avoid entirely the eastern coast and eastern rivers of Vancouver Island.

The sockeye making for Rosario Strait strike in abundantly off Cattle Point, at the southeastern corner of San Juan Island, furnishing opportunities for trap-net fishing, and also off the southern end of Lopez Island, directly east of San Juan Channel entrance, where for many years the Indians have made successful catches on the kelp-covered reefs. From near this point an offshoot of the run makes through Deception Pass into Skagit Bay and thence reaches the Skagit River, which, so far as known, is the only stream in this part of Washington which the sockeye enter in appreciable numbers, but the quantity is much smaller than in the Fraser River. Some sockeye work farther south, but where they leave the main run is not known and the quantity that moves in that direction is insignificant. They have never been reported from the salt waters of Puget Sound south of the neighborhood of the San Juan Islands, but have been observed in one or more of the small rivers which empty into it in that region.

The main eastern run, after passing around the southern end of the San Juan group, proceeds up through Rosario Strait and along the mainland of Washington to Boundary Bay and Point Roberts. During the first part of this movement, however, the fish seem to keep mostly out of sight, to the great bewilderment of the fishermen, who have been much puzzled at their failure to find good places for intercepting them. They have been reported in small quantities at the entrance to Bellingham Bay, but in Rosario Strait there are no distinctive places where they have been noticed abundantly before reaching the northern end of Lummi Island. Here they strike directly on the outer shore south of Village Point, where there is an important fishing-ground, both for reef nets and traps, which has long been resorted to by the Indians. Thence northward along the mainland shore as far as Boundary Bay they appear at intervals, but while nets have been set for their capture on some of the more prominent points, none of these had given satisfaction up to 1895, but whether on account of faulty construction or the scarcity of fish was not learned. The fishermen, however, have been encouraged to renewed attempts in this section and may yet succeed.

Boundary Bay and the waters about Point Roberts constitute a grand parade-ground of the sockeye, as it is here that the species uncovers itself in the greatest numbers in the salt water and to the best advantage for its pursuers. The quantity that appears at times is very large, and the catch may be enormous. The abrupt bending of the coast line toward the west in this locality interposes a barrier directly across the pathway of the fish, suddenly checking their progress toward the north and obliging them to make a sharp detour in order to complete their passage to the Fraser River. They enter Boundary Bay apparently in a broad front, and then turn westward, sweeping around Point Roberts. The nearness of their approach to land depends upon the depth of water and the direction of the wind. A southerly wind tends to drive them farther in the bay, while a northerly wind holds them out. They may enter the bay as far as the edge of the flats, thus crossing the boundary line to a slight extent, but the small catches made in the inner traps, and then only under the most favorable conditions, indicate their natural tendency to avoid the shallower water. Along the southern side of Point Roberts the much bolder shore permits the fish to come within a few yards of the beach, and this is also true for a short distance on the outer side, after rounding the southwest corner; but then soon begins the shoal or flat, which widens rapidly to form the extensive bank commanding the approaches to the Fraser River.

Much remains to be learned regarding the later as well as the earlier stages in the movement of the sockeye which pass through Rosario Strait. While the appearance of extensive schools in Boundary Bay and about Point Roberts is definitely established through the experiences of the fishermen, it can not be said that the entire eastern run approaches those localities so as to come within the range of observation, and it is very possible that some of the schools make the passage to the Fraser River at some little distance from the land. In fact, judging from the statements of the fishermen, when large bodies of fish are moving around the point they occupy a wide zone, extending some distance off shore and beyond the limits of the trap nets. The latter are, therefore, said to intercept only a very small proportion of the run, notwithstanding the amount of ground they cover. The schools on which the fishermen depend are chiefly those which enter well within the bay and, then circling, pass directly in front and within a mile or slightly more of the southeast corner of Point Roberts, called Cannery Point, which carries them over or around the large kelp-covered ledge south of that point. Their course is thence along the southern side of Point Roberts, keeping well in until they have rounded the southwest corner, when they begin to follow the edge of Roberts Bank (so called), over the deeper parts of which they soon become distributed.

The meeting-place of the two divisions of the sockeye run—one coming through the Canal de Haro, the other through Rosario Strait—is not known. Both are seeking the fresh water of the Fraser River and begin to feel its influence some distance off the shore. The flood which begins in the late spring continues during most of the summer, so swelling the volume of the river and charging it with fine sediment that the brackish and discolored water is carried a long way out into the Gulf of Georgia and covers, during practically the entire sockeye season, a relatively wide area. In this mixed water both runs assemble preparatory to ascending the river. It is also a common belief among the fishermen that they rest here for several days, or at least that all do not immediately begin the inland journey. While there is as yet no positive proof of this, it is not out of keeping with the habit of some of the salmon species elsewhere, and the prolonged periods of fishing which are enjoyed in this position make it appear at least reasonable. The extent of this assembling-ground, as brought out by the recent drift-net fishery, is from the neighborhood of Point Grey to about the boundary line, while off shore it seems to reach beyond the margin of the bank and even at times to the middle of the gulf, if the fishermen's accounts can be regarded as reliable. It is also reported, though the fact is not definitely confirmed, that occasionally a few of the fish work around Point Grey into Burrard Inlet.

Scarcely anything has been learned of the general habits of the sockeye in salt water. They take neither food nor bait and therefore lack the game qualities of the quinnat and the silver salmon. Unlike those two species, their salt-water home is exclusively in the open ocean off the outer coast. When they enter the Strait of Fuca they are bound by the shortest routes to their spawning-grounds, and if they tarry on the way it is only for short stops in the manner described above. The Strait of Juan de Fuca, Puget Sound, and the Gulf of Georgia are to them practically only enlargements of the river, through which they must necessarily pass, but in which they have no special functions to perform. The adult fish occur there only during the period of ascent, the season when they are fished for, July and August mainly. They appear to move in compact, defined bodies, of smaller or larger size, sometimes very extensive, another evidence of their transitory presence. Occasionally these schools appear at the surface, as has been especially reported at Point Roberts, but usually they remain lower down, although they may even then be seen at times in the clear waters, particularly when they are passing over the shallow kelp-covered ledges, which seems to be one of their delights, and which exposes them to capture by the Indian nets.

Statements regarding the rate of their movement in the salt water are greatly at variance, as is to be expected from the crude opportunities for observation up to the present time. Varying conditions, due to the season and the weather, are very likely to cause a difference in this respect. Schools reported at Becher Bay are said sometimes to make the Fraser River in five days, while again they may be as much as two weeks on the way. They may be taken at Point Roberts twenty-four hours before they are noticed off the Fraser River, or they may first be observed simultaneously at both of these places.

FRESH-WATER DISTRIBUTION.

The Fraser is the only river of British Columbia emptying into the Gulf of Georgia which the sockeye are known to ascend. In Washington this species seems to enter only the Skagit River in sufficient quantities for commercial purposes. It has been reported in very small numbers from Lake Washington at Seattle, but elsewhere in the fresh waters of the Puget Sound region its occurrence has never been positively recorded.

Skagit River.—The number of sockeye ascending the Skagit River seems to be considerable, although the run is in no way comparable with that on the Fraser River. They enter the former river by way of Deception Pass and Skagit Bay. Fishing is mainly carried on in the bay, where both trap nets and gill nets are employed. In the river the principal fishermen have been the Indians, whose operations have been chiefly limited to the vicinity of Baker Falls, but some fishing is also carried on by the whites. Up to 1895 this species was taken only in relatively small quantities either in the bay or river, but the establishment of canneries at Anacortes since then has greatly stimulated the efforts for its capture, causing a rapid development of the fishery. No details of its growth are at hand, but the size of the catch has apparently been much increased.

The only spawning-grounds which have so far been located in the Skagit River are at Baker Lake, on the tributary of the same name, having its origin on the slopes of Mount Baker. It is the general opinion that the entire run turns up Baker River and that it ascends no farther than the lake, but this supposition is not yet entirely confirmed. The inquiries already made, however, indicate that Baker Lake contains one of the most important spawning-grounds of the sockeye known to exist in the United States, and advantage has recently been taken of that fact to begin its artificial propagation in that locality.

It is reported that the sockeye begin to be taken at Baker Falls, near the mouth of Baker River, as early as the middle of June, but this so far antedates the time of their appearance elsewhere in the region that the evidence seems to be in error. They are also said to reach Baker Lake chiefly during July, and to begin spawning the last of August or early in September. The hatchery on Baker Lake was established by the State of Washington in 1896. The first eggs were taken on September 6 of that year and the last on October 8, when the capacity of the hatchery was reached, the total number obtained being 6,500,000. The season had not closed, however, by the latter date, and it was thought that fully twice that number might have been secured had there been means for caring for them. The number of fry obtained from the above eggs and planted in the spring of 1897 was 5,500,000. The output of fry in the spring of 1898 was 6,000,000, and 7,500,000 eggs were collected in the fall of that year.

In his account of this subject for 1898, the fish commissioner of Washington states that Baker Lake is about 1¾ miles long by 1½ miles wide, and has two principal inlets, Sutter River and Noisy Creek. The spawning-places of the sockeye occur in the lake and in both of these streams. The silver salmon and steelhead also run up to this locality in large numbers, and the quinnat appears here, though to a less extent.

Fraser River.—From the bank in front of the delta, where they first assemble, the sockeye pass into the Fraser River through both entrances, the main channel and the north arm, including also Canoe Pass, a short offshoot of the former. The relative proportion which enters each is said by the fishermen to vary considerably in different years, as well as in different parts of the same season, but their evidence in this regard is quite indefinite. They claim, however, that at times as good fishing may be had in Canoe Pass as in the main channel, through which the greater number might naturally be expected to make their way, as probably they do.

The species seems to distribute itself very generally throughout this river system, attaining the headwaters of its principal branches and entering a large proportion, if not the greater number, of its side tributaries, both large and small. During the years when the larger runs occur they make their appearance in many of these streams in extraordinary abundance. Pitt River, not far above New Westminster, is said to contain their nearest spawning-grounds to the sea, but the quantity which enters this stream is relatively small. Other lower tributaries which later runs ascend are Harrison River and Lake, Morris River, and Silver Creek.

Our knowledge of the season and movements of the sockeye in the Fraser River is based mainly upon the experience of the fishermen and canners, supplemented by the evidence of officers of the Canadian government connected with hatching operations and the fishery police. Scientific observations are wholly lacking, and it is therefore impossible to speak with confidence in regard to more than the main features of the subject. There is considerable variation in the date of beginning and ending of the season, the fish appearing and completing their movement earlier in some years than in others, although there may be more or less agreement in this respect during two or more succeeding years, followed by a marked change. It has been reported that a few sockeye sometimes work up the river in the latter part of May, but the testimony to this effect is of doubtful value. The fact is well established, however, that the species occasionally appears in small numbers during the last few days of June. Moderate runs may occur as early as July 4, but they are not generally expected in sufficient quantities to start fishing operations before the 10th of July, and even up to that date they may still be practically absent. By July 20 they should be running as heavily as they will at any time. A large run may occasionally take place at the very end of August, but the average fishing season ends somewhere about the 20th to the 25th of August, and years are recalled when nothing could be done after the first week of that month. Small numbers usually continue present during more or less of the early part of September, but with the near approach of the spawning period the fish rapidly deteriorate in appearance and condition and lose their commercial value.

The fishermen are inclined to recognize two distinct runs after the movement has fully begun, these being separated by a few days of poor fishing. This view, however, is not in accordance with the facts. There is, from the beginning of the season, a more or less constant fluctuation in the abundance of the fish. Larger bodies come from time to time, the quantity diminishing more or less in the intervals between, while frequently the fish become very scarce or may be entirely absent. There is no regularity in the matter and nothing on which the fishermen can depend. There are good years and off years, as they are called, following one another in a certain order, as elsewhere described, but even in an off year very successful catches may unexpectedly be made. The year 1895 belonged in the latter category, and during short periods some single boats took as many as 450 sockeye daily with their one drift net, while catches of 200 to 300 fish a day were made by many boats. During most of the season, however, the catches averaged no more than 25 sockeye daily to a boat, being often smaller, and frequently none was secured.

When the number of boats engaged in this fishery is taken into consideration, one comes to realize how great is the quantity of sockeye entering this river system, and how relatively compact at times must be the distinctive bodies moving upstream. With the appearance of the latter the catch suddenly increases, often to such an extent as to give the canneries much more than they can handle, and the excess is occasionally so great as to cause an enormous loss of fish. No other species of salmon is so abundant in the Fraser as the sockeye.

Observations which seem reliable indicate that, in a general way at least, the earlier runs proceed farthest up the river. The fish composing them are less mature when entering from the sea than those of the later runs and are better prepared to make the longer journey. Sockeye have been seen in abundance in the streams which empty into the South Thompson and in the Shuswap Lakes about the middle of July, yet on returning to the Harrison and other lower tributaries their total absence there was determined. It is on the later fish, eagerly seeking the nearest spawning-grounds, and with their reproductive organs well developed as they move upstream, that the Canadian hatchery relies for its supply of eggs. These are the runs which have been most closely observed and are best known.

The sockeye retains its freshness in the river longer than any other species of salmon except the quinnat and the steelhead. This must be chiefly due to the fact that its movement begins quite far in advance of the spawning season, and during nearly the entire period of its run through the lower part of the river the catch is always of a superior character, the flesh being firm and of good color, while the external surface is clean and inviting in appearance. Beginning the latter part of August, however, the fish rapidly deteriorate in condition, and the close season, which begins on August 25, is as much in the interest of the consumer as for the protection of the species. In 1894, by request, the Canadian government extended the open season a week longer on the plea that the sockeye were late in beginning to run, owing to the heavy flood which occurred in the early part of the summer. Such was probably not the fact, although the high water interfered with fishing operations, and the spawning season began no later than in average years. The extension was therefore deprecated by those having the best interests of the fishery at heart, and it is not likely to be repeated.

Whatever may be their stay in the brackish water outside the delta, when once inside the river their progress upstream appears to be quite rapid and continuous, if one may judge from the experience of the gill-netters, especially in connection with the weekly close time, which permits the rate of movement to be roughly measured. These observations relate to the main part of the river, and more particularly to that portion where commercial fishing is carried on, but the movement doubtless continues at much the same rate until the fish are in the neighborhood of their spawning-grounds.

The depth at which they swim while ascending the lower part of the river, where its volume is greatest and where the water is sometimes deep, is said to vary with the conditions. When the water is very muddy the fish are expected to keep nearer the surface than when it is more or less clear, and as the former condition prevails during practically the entire sockeye season, the depth of about 50 meshes adopted for the drift nets has been found to be as great as can both profitably and conveniently be used. In deep parts of the river more fish are taken at the sides than in midstream, and the same is true during times of flood. In shallow sections and during low water they spread out more widely, becoming more generally distributed or finding their way where the contour of the bottom affords the depths preferred.

PROPAGATION.

The sockeye and quinnat are understood to have substantially the same spawning season, which, in the Fraser River, is mainly from the middle of September to the middle or latter part of October, although beginning, in some seasons at least, a little earlier and continuing to a somewhat later date. It is supposed that the season is about uniform in all parts of the system, although nothing positive is known about the dates in the upper waters.

According to the late Thomas Mowat, for some time fishery inspector for British Columbia, the sockeye, as a rule, spawn in the small creeks that flow into the lakes and larger rivers, very few depositing their eggs in heavy, rapid streams, as the quinnat do. This is essentially in keeping with observations made elsewhere. At Karluk, Alaska, Dr. Bean found this species spawning in the main lake and in the short and rapid streams connecting each of its arms with smaller lakes. The spawning-grounds at the headwaters of the Columbia River, in Idaho, which have been carefully studied by Professor Evermann, occur only in streams tributary to the lakes or in the lakes themselves.

In 1884 the Canadian Government began the propagation of salmon on the Fraser River, at the solicitation of local canners and fishermen, who suggested a system of license fees and of taxes on the prepared products as a means of obtaining revenue for the purpose. The hatchery was established in the neighborhood of New Westminster, being completed in time to lay in a stock of that season's eggs, and was retained at the original site until about 1894, when it was removed to a place nearer the collecting-grounds. Attention was paid in the beginning to both the sockeye and quinnat. With regard to the former species, it was hoped to more nearly equalize the annual runs, the great diversity of which is described further on. As to the latter, it was desired not only to increase the supply, but also to introduce the more desirable grade from the Columbia River. The propagation of the quinnat was continued during only five years, however, and was restricted to native stock, the output of fry never exceeding about 2,000,000 in any one season.

The hatching of sockeye, started at the same time, has been continued down to date. The eggs have been mainly secured in Morris Creek, a tributary of Harrison River, the parent fish being caught and held in captivity until the spawn ripened. While the quantity of eggs to a female has been calculated at about 5,000 on an average, the number actually obtained from each has averaged only about 3,000 to 3,500, owing to the fact that, being mostly taken during the progress of the spawning season, many of them are more or less spent when they reach the pens in which they are confined.

The collecting season has varied in different years, beginning in some as early as the middle of September and in others not until about October 8, and ending all the way from October 15 to the first part of November. The period of incubation is relatively short, the fry being produced and planted during March and April following. With few exceptions the plantings have all been made in lower tributaries of the Fraser River, such as the Harrison, Stave, Little Lillooet, Pitt, and Coquitlan rivers. Between 1885 and 1890 relatively small numbers of fry and of semi-hatched eggs were placed in the Cowichan and Nanaimo rivers, of Vancouver Island, neither of which are natural sockeye streams, but so far as can be ascertained this effort at transplanting has met with no success.

The total number of sockeye eggs collected and the number of fry deposited in the Fraser River during each year since the establishment of the hatchery are shown in the following table, in connection with which it will be understood that the fry planted in any one year were derived from the eggs of the previous year:

Table showing the total number of eggs of the sockeye salmon collected and the number of fry deposited in the Fraser River from 1884 to 1897.

Year.	Number of eggs collected.	Number of fry deposited in the Fraser River.
1884	250, 000	....
1885	1, 487, 000	?
1886	4, 780, 000	?
1887	9, 325, 000	2, 405, 000
1888	4, 000, 000?	3, 870, 000
1889	9, 233, 000	4, 046, 500
1890	3, 861, 000	5, 540, 000
1891	6, 485, 000	3, 603, 000
1892	6, 237, 000	5, 600, 000
1893	6, 880, 000	5, 764, 000
1894	6, 752, 000	6, 300, 000
1895	6, 830, 000	6, 390, 000
1896	6, 770, 000	6, 393, 000
1897	6, 472, 000	5, 928, 000
1898	....	5, 850, 000
1899	....	5, 500, 000

Of the young of the sockeye little could be learned, and nothing of special interest. After hatching they are said to remain in the several tributaries until about June of the following year. A few grilse are reported to be taken occasionally in the river as well as in the salt water, but some question must attach to the identification of the specimens thus captured until they have been critically examined.

The initial steps toward the propagation of the sockeye on the Skagit River have been described in connection with that river, while the question as to what benefits may have been derived from the hatching on the Frazer River is discussed under the heading of periodicity, which follows.

PERIODICITY IN ABUNDANCE.

A periodicity in the abundance of the sockeye in alternating cycles of four years' duration has been recognized in this region ever since the first settlements were made upon the headwaters of the Fraser River by the Northwest Company in 1806. The species has been shown to attain its maximum abundance in every fourth year. The next season's run, while inferior, is expected also to be a good one, but those of the two following years should be relatively small. There is no question but that this fluctuation has occurred and that the sequence has been in accordance with the explanation given, but no standard can be fixed for measuring the extent of the variation. The differences, however, have been sufficiently great and regular not only to attract attention, but also markedly to affect the fishery and the canning industry. The canners have been enabled to anticipate in large measure the conditions of each approaching season, and to plan accordingly, thus regulating the extent of their preparations.

The statistics of the fishery alone do not furnish a suitable basis for determining either the occurrence or the regularity of this periodic variation, owing to the fact that the extent of the catch has often been influenced by the state of the market or the depression of trade. Thus, in the good years packers may have been led to greatly reduce their output, causing a shortage in the catch, while in poor years an active demand may have induced the fishermen to largely increase their operations. From information given in the official Canadian reports it has been possible to supplement the statistics by evidence as to whether the fish were actually abundant or scarce in any year, irrespective of the amounts captured in the nets, and while fine distinctions can not be drawn from this source the data seem to be sufficient to test approximately the correctness of the alleged periodic changes.

These facts have been brought out in the following table, in which the anticipated and actual conditions are shown for each year from 1877 to 1898. For reasons already explained it has been impossible to use other than very general terms to express these conditions, but they will undoubtedly serve the purpose here desired. The recurring cycles are indicated by the numbers in the second column, number one in each cycle standing for the year of maximum abundance.

Table showing the anticipated and actual conditions regarding the relative abundance of sockeye salmon for each year from 1877 to 1898, in illustration of the subject of periodic fluctuation.

Year.	Cycles.	Anticipated conditions.	Actual conditions.	Year.	Cycles.	Anticipated conditions.	Actual conditions.
1877	1	Good	Good.	1888	4	Poor	Very poor.
1878	2	do	Do.	1889	1	Good	Good.
1879	3	Poor	Poor.	1890	2	do	Do.
1880	4	do	Do.	1891	3	Poor	Fair.
1881	1	Good	Good.	1892	4	do	Poor.
1882	2	do	Do.	1893	1	Good	Good.
1883	3	Poor	Poor.	1894	2	do	Do.
1884	4	do	Do.	1895	3	Poor	Do.
1885	1	Good	Good.	1896	4	do	Do.
1886	2	do	Fell short.	1897	1	Good	Do.
1887	3	Poor	Good.	1898	2	do	Poor.

From an inspection of the table a correspondence will be noticed in the anticipated and actual fluctuations for every year down to 1885, inclusive. In 1886 the quantity fell much short of expectations, although the catch was kept up by an increase in the number of nets employed, and in 1887, which should have been a poor year, the run was better than in 1886. In 1895, also theoretically a poor year, the run was above the average, while in 1896, expected to be the poorest of its cycle, the catch is recorded as the third largest in the Fraser River fishery down to that time. As a whole, there were few measurable differences from the anticipated conditions down to 1892, since which time good runs have occurred during practically five continuous years. In 1898, however, which should have been a good year, the catch was relatively small.

The run of 1897 was one of the largest if not the largest in the history of the region. Preparations had been made in anticipation of a good year, both on the Fraser River and in Washington. The great body of sockeye first made its appearance about the middle of July and continued until about the end of the first week in August, a relatively short season, but during this period the cannery pack was completed and in addition an immense amount of fish was thrown away, the daily catch being often much larger than could be disposed of. It has, in fact, been claimed, though this is probably an exaggeration, that more fish were caught and wasted than were utilized. Where contracts had not previously been made, the canneries soon found it necessary to refuse much of the fish offered them, thus depriving many fishermen of their occupation through the very abundance of the objects of their pursuit. At Boundary Bay it is said that the traps filled faster than they could be emptied, while some of the gill-netters caught fully 1,200 salmon to a net in a single night, and many from 500 to 1,000 each. On the Fraser River the individual catches were in proportion.

While in 1897 the bulk of the catch was made early, the height of the season varies in different years. In 1890 and 1896, both of which were good years, the boats all made very small catches on the Fraser River until about August 10, when the fish began to run abundantly, raising the average daily catch per boat to from 200 to 500. In those years also, as well as in some preceding ones, the canneries became overstocked and many sockeye were destroyed. The catch of 1889 was likewise an unusual one, some of the contract fishermen earning as high as $1,500 during the season.

Several theories have been advanced to account for the periodicity in the abundance of the sockeye, which all seem willing to admit has continued, with at least some measure of regularity, down to within about a decade, but none of them is yet supported by conclusive evidence. An explanation is rendered easier if it be assumed that the sockeye makes but one spawning run, which seems in the main to be an established fact, and that its age at that time is four years, a point, however, which has not yet been determined from other evidence. On this basis, the size of any run having been established, the run of four years later, composed of its own progeny, might be expected to be of corresponding size; a large run to give origin to a large one, and a small run to a small one. The size of the initial runs, at whatever dates they are started, and the subsequent fluctuations in their size may readily be accounted for by the many vicissitudes which belong to fish life from the egg and embryo stages to adult age. Years of favoring conditions alternate in irregular sequence with those in which the conditions are adverse, and both at sea and about the spawning-grounds contingencies arise which may seriously affect or change the volume of any season's run.

Some of the greatest dangers of destruction undoubtedly exist in the spawning areas, where the eggs and the embryos are subject to much damage through the cold of winter, the force of freshets, and the washing of silt and gravel in upon the beds, and from one or other of these causes a large mortality must occur. Other agencies to be considered are the fisheries, both commercial and by the Indians, which remove a large amount of fish, but it seems improbable that either of these could be made to account for the periodic fluctuations. This is especially so as regards the white man's fishing, which did not become extensive until many years after the variations had been recognized, and in spite of which the sockeye seem to be no less abundant now than in early times. While the Indian methods and the extent of their captures are more likely to have had a bearing on the case, it seems more natural that their fishing should have affected all runs alike.

As before noted, one of the principal objects in establishing a hatchery on the Fraser River was to attempt to equalize the runs of sockeye, to make this species more abundant in off years, and thus, if possible, to provide good fishing every season. From the testimony of the local officers and fishermen, and even from the statistics of the last few years, it would appear as though something may have been accomplished in this direction.

In 1889 Fishery Inspector Mowat reported that the parent sockeye had become more plentiful in the small creeks where the fry had been deposited, and thought the increase in Morris Creek had been tenfold, as in 1885 and 1886 they could scarcely secure any fish there, while in 1889 they caught them numerously. This explanation of the increase is scarcely tenable, as the number of fry set free in 1886 was not above 1,000,000—less, had they all survived, than one-third the total Fraser River catch of 1887. Mr. Mowat, moreover, attributed the good catch of 1887, which ranked as an off year, to the same cause, but this would have allowed for only three years' growth from the time the first eggs were taken (not hatched), and the total number of those eggs was only 250,000.

It is to the last few years that we must look for the most positive evidences of the success or failure of hatching operations, following the steady planting for a decade and over, and while the quantity of fry deposited in the Fraser has not much exceeded 6,000,000 annually at the most, being generally less, with a high percentage of survival it is possible that an impression has been made. Not only were the conditions improved in the poor years of 1895 and 1896 by some cause, if not by this one, but the effects were also felt in the years of greater anticipation which immediately preceded and followed them, though the greatly reduced catch of 1898, which should have been a good year, is to be noted in this connection. The present inspector of fisheries accredits these results to the combined influence of the hatchery and of better protection in the upper waters, where the Indian methods of barring the passage of spawning fish have been suppressed wherever possible. He also claims the recent establishment in Morris Creek, where the hatchery supplies have been obtained and where much of the fry has been deposited, of a type of sockeye which spawns later than any of the runs observed during the earlier operations in that locality, and these he supposes to be the product of artificial propagation. These late spawners are in great abundance every year, even when there is a scarcity at other breeding-grounds. The observations of Mr. McNab in regard to this matter are of much interest, and if the facts are substantially as he states them it raises again the old question as to whether salmon always return to precisely the same ground where they were hatched and make their run at the same relative time of the season as the parent stock from which they were derived. There are no data at hand for reaching a conclusion in this matter, with respect especially to such a complicated system as is presented by the Fraser River, but should the proposition so often raised be the true one, then the hatching work on this river would be productive only of late-running fish, those from which the eggs have been taken. These late runs probably occur, in part at least, after the close season has begun, and are of little or no benefit to the fishermen, but until the subject is better understood we are perfectly justified in giving the experiment the benefit of the doubt, and in regarding with favor the work accomplished.

MORTALITY AFTER SPAWNING.

During our inquiries of 1895 no new positive information was obtained regarding the extent to which the sockeye return to the ocean after accomplishing the object of their journey into the fresh waters. The testimony secured on this subject did, however, emphasize the fact that the mortality after spawning is very great, and is shared by all the species of *Oncorhynchus*. The waters about and directly below the numerous spawning-grounds become charged with great numbers of dead salmon, whose decaying bodies fill the air with the odors of putrefaction, but, while the stench becomes almost unbearable, no widespread pollution of the Fraser or Skagit rivers seems to result from this cause. Detailed observations to determine the proportion of deaths are wholly lacking. Those who have observed the conditions are not in accord in their deductions, though all agree in placing the death rate very high, especially as regards the humpback, dog, and silver salmon, as well as the sockeye. Some feel confident that of these species none survive, while others are equally certain that only a part meet death.

The only serious attempt at a solution of this problem in British Columbia was made by the late Thomas Mowat, whose experiments, however, were cut short by his unfortunately early death. The most complete account of his observations and deductions that we have seen are contained in an unpublished letter written in 1890, from which the following is an extract:

> I have much pleasure in informing you that I have proof without doubt that the *Oncorhynchus* or Pacific salmon do in many cases return to fresh water annually for the purpose of reproducing their species. I have proof of this in the case of the quinnat (*O. tschawytscha*) and sockeye (*O. nerka*), and I am confident from observations I have made that the coho (*O. kisutch*) do return in larger numbers than those first mentioned.
>
> During the seasons of 1884, 1885, and 1886, I made use of a leather or harness-maker's punch to mark the quinnat salmon after they had been partially stripped of their eggs and were obliged to be returned to the pens. The marking was done by punching one or more holes through the adipose dorsal fin, then passing a piece of colored cotton cloth or twine through the hole, so as to distinguish them from the fish that had not been handled. Sometimes we cut a portion or the whole of this fin off, and those fish were returned to the water after we had finished stripping them. Two successive years later a few of the fish so marked passed through our hands and were recognized, and I learned that some had been taken by the netters. It must be understood that the strings were not left on the fish. The fin was found to be withered somewhat, with the hole partially grown up. Since the season of 1887 we have been operating on the sockeye, and, as I have already described, some of these were marked in a similar way, but owing to having so many in the pens we had to keep different marks on them, so that the tails of some were bent or doubled up, a piece being taken out. Two of the fish marked in this manner were taken by netters this season and sent to me.
>
> My contention has always been that at least four species of our salmon return to the rivers to reproduce. The fourth, including those alluded to, is the steelhead, of which none die except by accident. My opinion is that 75 per cent of the quinnat salmon survive that ascend from 75 to 100 miles inland; those that ascend from 100 to 1,000 miles, or reach the summit of the Rocky Mountains, are reduced from various causes down to from 5 to 25 per cent. The percentage of the sockeye that survive are slightly under the quinnat, while those of the cohoes are over, as they do not ascend so far inland and have a better chance of returning. The qualla and humpbacks die in larger numbers, as they are more pugnacious, spawn in shallow water, and are more liable to disease. I quite agree with you as to the views

held in reference to the salmon returning. They no doubt descend very rapidly, and either in the deep water of the center of the streams or along the shores, where they are less apt to come in contact with nets. I have on several occasions noticed the spent sockeye salmon swimming down this river toward the gulf, and I have been informed by the netters that they have taken them; but of course there is not the same chance of capturing them on their return to the ocean.

Observations made elsewhere in Pacific coast rivers do not confirm Mr. Mowat's conclusions regarding the sockeye. Dr. T. H. Bean, who made a study of the Karluk River, at Kadiak, Alaska, in 1889, expresses the opinion that no spawning sockeye leave that river alive, although they may live in the lakes at its source during more or less of the winter.

Prof. B. W. Evermann, who has given much attention to the salmon question in the headwaters of the Columbia River in Idaho, and whose statements are based on most painstaking observations, says of the sockeye in that region:

> What becomes of the redfish after spawning? Our observations, made at Alturas and Payette lakes in 1894 and 1895, and particularly those at Alturas Lake in 1895, which have already been given with considerable detail, leave no doubt as to the answer to this question. The redfish which spawn in the inlets to the Idaho lakes never return to the sea, but all die at the close of the spawning season. The evidence is conclusive.

Had Mr. Mowat been spared to continue his inquiries during a longer period, it is to be expected that he would have succeeded in throwing much light upon this still perplexing question. In the face of the other evidence just cited, it can scarcely be admitted that his deductions are conclusive as regards the sockeye. While Professor Evermann's observations relate to waters at a long distance from the sea, the Karluk spawning-grounds are much nearer to the ocean than any in the lower tributaries of the Fraser River.

An argument may be based upon the uniformity in size of the fish, but not safely without support from other evidence. Thus the sockeye, silver salmon, and humpbacks each run quite uniform in weight, the majority of those which enter any river averaging about the same. Did they make repeated ascents, the older fish might be expected to attain successively larger sizes, but as the sizes vary little, it is natural to assume that, with possibly few exceptions, they make but the one journey—are adapted to spawn but once. That a few escape might explain the occasional capture of larger sizes, as reported from time to time. The quinnat and dog salmon, on the contrary, exhibit a considerable variation in size, suggesting the survival of a greater proportion of the fish after each spawning, a greater power of longevity, and the opportunity of making two or more runs. Notwithstanding this argument, however, the dog salmon have been counted among those which die most readily after spawning.

From a practical standpoint the question of mortality may be assumed as having some importance for consideration in connection with regulations for the protection of the salmon. If all the individuals of a species composing a season's run die at their spawning-grounds, why is it necessary to provide for the escape past the nets of the fishermen of more than are required to insure the perpetuation of that species by spawning? If, on the contrary, the mortality is small and the same fish ascend through two or more seasons, then those which escape capture one year may be regarded as saved for the benefit of the fishermen in succeeding years.

In either case, however, the distinctions to be drawn are very fine, and it is difficult to conceive of a regulation based upon such conditions in view of the uncertainty attending all fisheries, and especially one whose operations are so extensive and whose resources are still so untried as the salmon fishery of this region. A sufficient quantity of salmon should be permitted to pass the nets to insure with absolute certainty the maintenance of the supply. The proper number for that purpose can never be accurately determined, but prudence demands a very large margin.

QUINNAT SALMON.

The quinnat, *Oncorhynchus tschawytscha* (Walbaum), known also in this region as the tyee and spring salmon, is recognized here, as elsewhere, as the finest in quality of the Pacific group of salmon, its flesh excelling that of all the other species in richness and delicacy of flavor. It is not, however, nearly so important commercially as the blueback or sockeye salmon, being much less favorably regarded for canning purposes, mainly on account of the lighter color of its meat. Still, for other uses, and especially for the fresh trade, it is most highly prized, and, excepting the peculiar white-meated individuals hereafter to be described, there is demand for all that can be taken.

While with this as with the other species, it has been necessary to depend chiefly upon the market fishermen and sportsmen for a knowledge of its movements, enough has been learned to establish several points of interest and to indicate that this region offers an exceptional opportunity for rounding out the life history of this conspicuous member of the salmon tribe.

The quinnat differs markedly in its habits from the sockeye, and is apparently always present in the Gulf of Georgia and in Puget Sound, where it may be captured at practically all times of the year. This fact would seem to indicate that the inner salt waters of the region furnish conditions suited to its welfare during all seasons, although, of course, its entry into fresh water is essential for spawning purposes, and it is to be presumed that a certain proportion finds its way to the ocean every year.

During the winter months good hook-and-line fishing is obtained in several places, and probably would be found in many others were trials made, but operations of this character are as yet restricted both as to locality and number of men employed, the Indians being the principal participants. The quinnat do not apparently then congregate together in as large or compact bodies as during the period when their movements toward the rivers are taking place. They are more scattered and seemingly remain more constantly, if not always, below the surface, and to some extent at least in comparatively deep water. It is accordingly impossible to judge of the general abundance of the species in the inner salt waters at that season, or of the proportion which may seek winter quarters in the open sea, if any do. They are observed and may be taken at different places through the Strait of Juan de Fuca, but it could not be learned that they move through this passageway in such defined schools as are characteristic of the other species. Should they do so, however, they may swim too low to fall under the observation of the fishermen. From all the data that have been collected it seems not improbable that the species, in general, never goes far from land, this view being strengthened by the fact that the river runs begin very early in the year.

In the stomachs of individuals captured in the Gulf and Sound, shrimps, herring, and other small pelagic fishes have very commonly been observed, showing positively, if such proof were needed, that they avail themselves of the opportunities for feeding afforded by the inner waters, as good undoubtedly as could be found upon the outer coast. It is this circumstance which leads to their taking bait and makes them the object of a hook-and-line fishery, both for market and for sport. Whether they continue feeding in the salt water during the spring and summer was not learned. They are said to refuse both food and bait during their passage up the Fraser River, which is in accordance with the general understanding of their fresh-water habit, but exceptions to this rule seem to have been quite clearly demonstrated in the case of certain small rivers which will be referred to again.

The line fishing or trolling is carried on mainly during November, December, January, and February, by both Indians and whites. The principal localities brought to our attention were off Nanaimo, Howes Sound; off the estuary of the Fraser River; off Victoria, Becher Bay, among the San Juan Islands; off Port Townsend, off Port Gamble, and in Hoods Canal. One of our informants had often fished successfully for the quinnat during these months at Nanaimo within 10 yards of the wharves, using spoon bait. The fish occurring there would disappear in February, beginning then to make their way up the rivers. Another informant described the general fishery off Nanaimo as deep-water trolling with herring bait and spoon, which continues until into March or April, after which the fish become scarce. At Victoria winter fishing is carried on to a distance of 8 or 10 miles from shore, chiefly from December to February, inclusive, the Indians going out whenever the weather is suitable. Supplies are also received at Victoria from Becher Bay. Some fishing is done at Port Townsend close by the wharves and farther off shore, but the fish do not seem to be as abundant there as in other places. The San Juan Islands afford good winter grounds, and quinnat are also taken among those islands in April and May.

The quinnat commence schooling and running as early as February. On the upper part of the Washington coast the first run occurs in that month, the fish following the herring north around Point Roberts. A second run is said to begin the latter part of April and to continue during May and June, small numbers also passing Point Roberts during the remainder of the summer, when they may be taken in the traps set for the sockeye. The fall run starts in the latter part of September and ends some time in October. Among the San Juan Islands the movements were described as practically the same.

This species seems to enter many, if not most, of the rivers of this region, the abundance in each being measured by the size of the stream. A few, it is said, may be found in the lower 40 miles of the Fraser River during the entire winter, but nothing is known of their habits there at that time. Scattered individuals begin to enter and ascend the river in February, and in some years, it is claimed, as early as January, dependent upon the openness of the winter, but the species remains scarce until in April. Some fishing may be done the last of March, but not until the river becomes somewhat discolored by the spring freshets are the conditions favorable for the extensive use of drift nets. The main part of the spring run occurs in May and June, being heaviest in the latter month, when the best fishing may be had. As July comes on the supply drops off, and during that month and August only a few are obtained, in conjunction with the sockeye. The fall run, commencing generally in the latter part of September and continuing into October, while of some importance, is much inferior to the spring run.

The quinnat apparently distribute themselves quite generally throughout the Fraser River system, and ascend the different branches as far as conditions permit. The earlier or spring runs travel farthest upstream, the fall fish, it is said, spawning in lower tributaries, one of which is Pitt River, only about 50 miles above New Westminster, and another, Harrison River, somewhat higher up. The spawning season, according to Canadian authorities, is mainly in the latter part of September and during October.

The artificial propagation of the species was taken up on the Fraser River in 1884, at the same time as the sockeye, but was discontinued after five years' trial. It had been the original intention to obtain at least a portion of the spawn from the Columbia River, with the object of attempting to increase the proportion of fish with more deeply colored flesh, but this part of the plan was never carried out, operations being entirely confined to the local run. The parent fish were caught with dip nets at night in swift water on the Harrison River rapids, where they lay, and were held in cribs awaiting stripping. According to Mr. Mowat, the species is hard to strip, and in some cases it is necessary to handle the fish two or three times to obtain all their spawn. The eggs are large and vary a great deal in color. Their number is small in comparison with the *Salmo salar*, averaging only about 4,000 to each fish, and the period of incubation is very much shorter, this being accounted for by the temperature of the water, which is higher in the Fraser River during the winter than in the salmon rivers of the Atlantic coast. Parr kept to the age of seven months attained a length of 3 to 4 inches. The total number of fry planted during the five years was only about 6,000,000, an amount quite insufficient to have any appreciable effect toward increasing the supply.*

Very little information was obtained regarding the runs in other rivers than the Fraser, as not much fishing is done in any of them, but the seasons are essentially the same in all, so far as could be learned. We were told, by a close observer acquainted with the region, that in the Cowichan and Nanaimo rivers of southeastern Vancouver Island they begin running about the time the snow freshet commences in February. During the early part of the season they ascend leisurely, stopping in the pools, where good sport fishing may be had, and finally reaching the lakes at the head of both rivers, where they remain until the spawning time. Later runs occur up to and including the early fall. In Washington the Skagit River furnishes the largest catches which reach the Seattle market, but they are regularly fished for on several other rivers.

Eighteen pounds is given as a fair average size for the quinnat on the Fraser River, but in the Seattle market the average was placed between 20 and 25 pounds. In the market catch they range down to about 10 pounds, and individuals weighing 40 to 50 pounds are taken to some extent. The extreme sizes brought to our notice were 60, 70, and 80 pounds, but these are rare.

Notwithstanding the generally high esteem in which the quinnat salmon is held, it exhibits in this region a remarkable peculiarity, only exceptionally occurring elsewhere, which seriously affects its sale. While in some of the fish the flesh has its ordinary deep pink color, in others the flesh is white, or only slightly tinged with pink. All intermediate gradations of coloration, as well as intermixtures of the two, occur, and no degree of this variation is distinguishable from the outside. One end of the fish may be pink and the other white or the two sides may differ in this respect. White stripes may extend through the pink meat, or the reverse, and spots of one color may be disseminated through a mass of the other. In the paler fish the color may greatly fade or disappear entirely during the process of cooking, salting, or canning. In a letter transmitting specimens to Washington for examination, in 1887, Mr. Mowat describes the conditions as follows:

> I find that some of the run are pure white; some are very pale pink; some a little darker, and others of a fair color, like the samples sent. I also find that some are white on the outside near the skin for about 1 inch in depth, then gradually turn a pale pink, deepening in color as the bone is reached. A few fish of this description

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* Since the above was written information has been received regarding a private hatchery built on Samish Lake, near Fairhaven, Wash., in the fall of 1898, in which about 200,000 quinnat eggs from the Columbia River were at once placed, and also about 100,000 eggs of the silver salmon from local sources. An effort is being made to have the State assume the expense of running this hatchery and to have its capacity enlarged.

are found among the July run, but the majority of the quinnat salmon running now are white or pale pink. Fish wanting in color are not canned, as cooking will draw the balance of the coloring from them. On examining a number of these fish a few days ago, I found some of them with a slight tinge of pink around the bone and that the majority of them would spawn within a month. The ova, like the fish, also varied in color; but the lighter they were, the larger and nearer to maturity. The same particularities as to color occur in eggs taken from the fish on the spawning-grounds.

The lighter or off-colored fish are said to be found at all times, but their proportionate number may vary more or less at different seasons. Thus, for instance, on the Fraser River the white-meated fish are reported generally to form only a small percentage of the spring catch, though their number may increase toward the end of the spring run. Beginning in August or by September 1, however, the number becomes very large, and before the season closes may reach as high as 60 to 90 per cent. In Puget Sound and the more southern rivers, on the contrary, it is claimed that the percentage remains more nearly uniform throughout the fishing season, although the average color may turn a little lighter as the season advances, and that the percentage of the white-meated fish is not so large as at the north. That so marked a difference as is described should be manifested in a region of such limited extent is striking if true, but it is not at all improbable that the statements are somewhat at fault. There is no doubt, however, that a very large number of the light-colored fish are taken. Epicures claim that their meat is as rich and as well flavored as though it possessed the deeper color, but by people generally the salmon are graded according to color, whether fresh, canned, or salted, and a prejudice exists against any which have not the prescribed shade. There is, therefore, scarcely any sale for the paler fish. When placed upon the market fresh they command a very inferior price, while canned or salted they rarely find a purchaser. It is hoped that this prejudice will soon be overcome, permitting what is now essentially a waste product to be utilized in accordance with its true value.

Leaving the question of color out of consideration, the quinnat are said to be always in good condition when taken in the salt water, the winter catch being the best. During their movements up the river they are also in prime condition in the spring, but as the summer advances, especially by August, they show considerable deterioration, which increases as the spawning season approaches, until finally they practically cease to have any market value.

The quinnat taken in this region are most highly valued for the fresh market. There is, in comparison with the extent of population, a relatively large local sale, and in the spring a considerable export trade to the Eastern cities of the United States. The latter begins at an early date and continues on rather an extensive scale until about the 1st of June, by which time generally the season for the Atlantic salmon has fairly opened and the demand comes practically to an end. It may, however, still be shipped for a time in small quantities to inland points as far east as Chicago. The spring trade is said to be constantly increasing, and in a frozen condition the species is now being sent to foreign countries. A considerable quantity is also salted for export, and after the heavier shipments to the East have ceased, and the high price then prevailing has fallen in consequence, they may be put up by a few of the canneries, especially on the Fraser River. By the time the canneries are in full operation, however, the quinnat have become scarce, and in the fall their quality has depreciated, while the inconvenience occasioned by the number of light-meated fish in the catch causes many of the canners to avoid handling them even at a season when their condition might otherwise be favorable. The canned quinnat of good color is graded about with the sockeye, the deeper and more stable tint of the latter increasing its relative value as compared with the quinnat, despite the inferior quality of its flesh.

On the Fraser River commercial fishing for the quinnat is restricted to the use of drift nets. On the Washington coast the species is obtained only to a limited extent in traps, which are seldom set until after the principal runs are over, and the catch therefore consists mainly of scattered individuals taken in conjunction with the sockeye. No dependence is placed upon the species at Point Roberts, and it has not been the practice to fish for it specially at that place. Nets are used for its capture in some of the rivers of Washington. Its game quality has led to a considerable fishery in the salt water with hooks and lines, which is carried on mainly for profit, but also to a slight extent for sport. The fishermen are chiefly Indians, and the season is principally the winter, beginning in November. The method followed is trolling with both bait and spoon at various depths below the surface, dependent on the position of the fish. Herring is the bait usually employed. The principal localities of this fishery have already been enumerated. While no statistics on the subject are obtainable, the catch by this means is probably very inferior to that made by nets in the various waters of British Columbia and Washington.

SILVER SALMON.

The silver salmon or coho, *Oncorhynchus kisutch* (Walbaum), ranks next in importance after the sockeye and quinnat. It is considered the most handsome of the salmon tribe, and in the salt water has game qualities in common only with the quinnat. The color of the flesh, though much lighter than in the sockeye, is as deep as in the quinnat, but it fades to such an extent in cooking as to make the species less desirable for canning than either of the former. The flesh is also drier or less oily, but of excellent quality for the table when fresh, and packs nicely. The Indians prefer this species to the sockeye for their own use, probably because it is more readily cured by their process of drying.

The size, as observed in these waters, is reported to range from 2½ to 10 and 12 pounds, but to run generally from about 6 to 8 pounds. The species is said to attain 30 pounds in Alaska.

There is some uncertainty regarding the length of stay of the coho in the salt waters of this region. From what appears to be good authority it was learned that individuals have occasionally been caught by trolling in the spring and early winter. It has a well-defined run, however, and occurs abundantly only during a limited season, lasting generally about six weeks. The date of its first appearance varies in different years, as well as in different places during any one year. The schools are expected to arrive between the middle of August and the first few days in September, being reported earliest at points along the Strait of Juan de Fuca, sometimes, it is said, before the middle of August.

In Puget Sound the earliest recorded catch for the Seattle cannery was made on August 28, 1889. In connection with the fishery in that locality no preparation is made for taking silver salmon before September 4, and no reliance is placed on the species after October 23, though large supplies have been obtained as late as October 28 in the vicinity of Everett, while in other localities the fishery has continued until November 1. A few may even be taken as late as between the middle of November and 1st of December, after which they are rarely seen.

In the Fraser River, while the coho may begin ascending even before the sockeye season has fairly closed, they are not expected to run abundantly until about September 10. Their movement continues through most or all of October, but the duration of the main run is said to be only from four to six weeks. The date of running in the other rivers is probably about the same. A few may appear in the Washington rivers as early as August 15 to 20, but they do not become abundant until some time later, and may continue ascending until the last of October.

The silver salmon become widely disseminated through Puget Sound and the Gulf of Georgia, and enter many of the narrower channels among the islands, in which respect they differ from the sockeye. They ascend the smaller as well as the larger streams of the region, but in the Fraser River they apparently do not proceed very far above the sea. Much of their spawning-ground is just beyond the influence of the brackish water, and for spawning purposes they may enter even little creeks and rivulets in which the water seems scarcely deep enough to admit them.

Their spawning season, according to the testimony of Canadian experts, begins about the middle of October and continues until about January, but it is supposed to occur mainly during November. In 1885 a few thousand eggs were hatched artificially at the Canadian hatchery on the Fraser River, but no serious attempt has been made to increase the abundance of the species by this means.

The silver salmon are described as active rovers in the salt water, and their habit of leaping makes them readily distinguishable at the surface. They occur in large bodies and also thinly scattered over extensive areas, being erratic in their movements and often changing their position rapidly. Near the close of October, 1886, after the fishing season had apparently ended, schools were reported off the town of

Everett. Two purse seines were immediately put in operation, and in one haul it was estimated that fully 10,000 fish had been surrounded. The fishing was continued uninterruptedly during three days, the quantity assembled being the largest ever known, but on the fourth day they had entirely disappeared, and none were subsequently observed in this locality. This sudden disappearance from the salt water in the fall is said to be the rule, and those fishing for the species find their occupation abruptly terminated. The last of the large bodies must therefore make a quick move toward the rivers and their spawning-grounds. The important fishing-grounds in Puget Sound extend mainly from the vicinity of Everett to Tacoma.

There is a considerable variation in the general abundance of the species from year to year, and also as regards different parts of the region. Thus, while they may be scarce in some localities and exceedingly plentiful in others during any one year, the following year these conditions may be more or less reversed, and this applies to the rivers as well as to the salt waters.

There is a reported decrease in the quantity of this species observed in certain places, as in Semiahmoo Bay, Birch Bay, Bellingham Bay, Samish Bay, and Elliot Bay, but if such a decrease has actually taken place there is nothing to show that it is more than local in character. In Elliot Bay and some other places the fishermen claim that it is due to the amount of steamboating now going on. In the other bays above named the decrease has been charged against the continued heavy fishing by seines at the period when the coho are entering the rivers.

The silver salmon appears not to be canned on the Fraser River, except in the case of a shortage in the pack of sockeye. The same is also true in principle with regard to most of the Washington canneries, but in fact it has been so difficult to obtain sufficient supplies of sockeye at nearly all the latter that the silver salmon is extensively used in place of it, and it also composes an important part of the catch made for the Seattle cannery, where the sockeye is not put up. It is extensively salted on the Fraser River for the export trade, and is one of the favorite species with the Indians for their own use.

The traps at Point Roberts, Lummi Island, and the San Juan Islands are mostly removed before the run of silver salmon is fairly on, but some may be left in place for the special purpose of obtaining this species if the sockeye catch has been small, and it is also taken in the traps in Skagit Bay. The main supply from the salt water, however, has been obtained by means of purse seines, although drag seines and reef nets are also used, the former chiefly at the mouths of the rivers. On the Fraser River the fishery is by means of drift nets.

The silver salmon, like the quinnat, affords good sport fishing in the salt water, and may be taken by trolling, either with or without a spoon. This method is resorted to for commercial purposes in some localities, but the catch is small. It is also said that they may be taken in this way in the lower 2 or 3 miles of some of the small rivers.

THE HUMPBACK SALMON.

The humpback salmon or "haddo" of the Indians, *Oncorhynchus gorbuscha* (Walbaum), is a small species, averaging only about 4 or 4½ pounds in weight, although the male may reach as much as 6 pounds. From the sockeye, with which it is most commonly associated, it is readily distinguished by the shape of the body, the much finer scales, and the coarse spots on its tail. In the salt waters of this region it occurs chiefly during August, though appearing generally the latter part of July, and may continue present into the early part of September. Its season, therefore, practically corresponds with the last half of the sockeye run, and the two species are often obtained abundantly together in the trap nets, much to the annoyance of the fishermen, as the humpback is in little favor either for canning or other purposes. A peculiarity of the species is the fact that it makes its appearance only in alternate years, those indicated by odd figures, as 1895, when we had the opportunity of examining many specimens. If any are present in off years they are so few as to escape the notice of the fishermen.

During the years of their occurrence they are exceedingly abundant. They are said to move slowly, in large schools, rolling in the water somewhat after the fashion of the porpoise, with the dorsal fin showing at the surface. Dr. Bean says of them in Alaska that they are much addicted to jumping out of the water, one of the commonest sights in the vicinity of St. Paul, Kadiak, being the breaching of the humpback. In Puget Sound and the Gulf of Georgia this habit was ascribed only to the silver salmon. Although quite a vigorous fish, the humpbacks die quickly when taken in the nets.

In Puget Sound, where they are regularly fished for, the earliest catches are generally obtained during the first week of August, and fishing is expected to continue until the end of the month. Small numbers have occasionally been taken as early as July 24, and large hauls have been made as late as September 8. The season is probably approximately the same for all parts of the salt waters, except that they would be expected to appear somewhat earlier in the Strait of Juan de Fuca, and occasional small captures by the drift nets have been reported in the lower part of the Fraser River by July 20.

While the humpbacks enter at least most of the rivers and smaller streams of the region, they are said to avoid certain ones, but the testimony in this regard is not conclusive. They apparently do not ascend very far above the sea, although they may reach the headwaters of the shorter rivers, to which class, in fact, belong most of the rivers along this coast. They enter all of the lower tributaries of the Fraser River, from Burnaby Lake at New Westminster to Harrison and Chilliwhack rivers, and probably to a short distance farther up. They require but little water for spawning, and even resort for that purpose to the narrowest and shallowest creeks, sometimes not over a few feet wide, and a foot and a half deep. In their spawning-places they congregate in such exceeding abundance that they are described as forming at times almost a solid mass, from which the stench produced by the dying fish is said to be intolerable. The spawning season on the Fraser River is reported to be from the latter part of September to the middle of October, and the occasional association of the humpback with the sockeye on the same grounds during this period has given trouble in securing the eggs of the latter for the Canadian hatchery.

The flesh of the humpback is of a very light pinkish color and much softer than in the sockeye and quinnat, for which reasons the species is not highly regarded for canning, and has been regularly used for that purpose only at Seattle. The fish deteriorate rapidly, especially when caught in large quantities and heaped in scows from the traps or seines. Those in the lower layers, especially, soon become damaged and misshapen and lose their scales, greatly detracting from their appearance. Nevertheless, the humpbacks are considered by many as having excellent food qualities when taken in the salt water, particularly during the early part of the run. In some of the local markets they are sold fresh in small quantities. On the Fraser they are salted and smoked for export to China and other countries demanding a cheaper grade of salmon, and many are taken and prepared by the Indians for their own use, both in the fresh and salt waters.

The output of the cannery at Seattle consists largely of the humpback, which, selling at a low price, finds a ready sale in the southern part of the United States. The supplies for this cannery are obtained mainly in the salt waters near and to the north of Seattle, by means of drag seines hauled on the beaches. Small quantities are also brought from some of the rivers. In the season of 1891, four seines operating for this cannery made a total catch of 275,000 fish, but this represents only a part of the fishery that was in progress that year.

The local demands in other places along the shores are also chiefly supplied through the agency of drag seines, while on the Fraser River the commercial fishery is by means of drift nets. The trap nets would appear, however, to afford the best means for the capture of the humpback in the salt water, and they are sometimes so taken in immense quantities during the sockeye run. In fact, they often compose by far the larger part of the catch, and as it is generally impracticable to do the sorting in the water at the net, the entire catch may be emptied into scows and the overhauling take place at the wharves. Here the humpbacks are culled out and discarded, causing a wholesale destruction of the species. There seems to be no immediate solution of the problem as to how this loss might be prevented, but the question calls for serious consideration, as incalculable harm may be done the supply of humpback in the course of a few years, by which time its market value is certain to be much increased.

DOG SALMON.

The dog salmon, *Oncorhynchus keta* (Walbaum), comes next after the quinnat in size, but differs greatly from that species both in habits and in the quality of its flesh, while its peculiar color markings readily distinguish it from all other forms. On the Fraser River it is said to weigh mainly from 12 to 15 pounds, although many are taken up to 25 pounds, and individuals have been caught weighing 40 pounds and over.

Very little has been learned regarding its movements. A few may occasionally be secured as early as the middle of August among the other salmon. The regular run, however, is stated to begin in September and to continue through October and more or less of November, sometimes not ending until about December 1. In the purse-seine fishery tributary to Seattle the first catches during the six years from 1889 to 1894 varied in date from September 10 to October 17, and the last from October 27 to November 17. These figures, however, can not be assumed to indicate at all positively the duration of the run in any of those years without other information, as in some seasons the fishery may have been started late or may have terminated before the run had ceased. In January, 1897, dog salmon were reported present in the salt water, being then in good condition and having the appearance of just coming in from the ocean.

This species, like the humpback and silver salmon, seems generally not to ascend the rivers far above the sea, but it enters all streams, large and small, going even into the little creeks for spawning. Its distribution in the Fraser is limited to the lower tributaries, but while it is there considered one of the least abundant species, in some of the smaller rivers elsewhere it appears in relatively very large numbers, the fish crowding together in narrow and shallow places, which become badly polluted by their dead and decaying bodies. According to Mr. A. B. Alexander, in the fall and winter all the small creeks, lagoons, and sloughs near the Dwamish and Cedar rivers, Washington, are filled with dog salmon, and boys find great amusement in killing them with clubs and stones. In the rivulets by the roadside, where the water is not over 2 or 3 inches deep, dog salmon may be seen trying to get farther upstream. Mr. Mowat says that they spawn principally in quiet creeks and in the shallow waters along the river banks, even doing so in water so shallow as to leave part of the back exposed.

The dog salmon are not generally held in good repute, although when taken in the salt water, especially soon after coming in from the ocean, their flesh is firm and they are handled to some extent in the fresh markets of Washington. They are regularly canned at Seattle, and small quantities have been put up at one or more of the other Washington canneries, the supplies for this purpose being obtained in Puget Sound by means of purse seines. The color of the flesh, which is always light, is said to grow paler as the season advances. The fish deteriorate rapidly after entering fresh water, and the jaws in the males become very much hooked. The Indians on the Fraser River and elsewhere make use of the species to some extent, more particularly when the other salmon are scarce.

STEELHEAD.

This large trout, the *Salmo gairdneri* of Richardson, is commonly classed as one of the salmon by the fishermen of this region, and is customarily sold as such. In different localities its average weight was placed at from 8 to 15 pounds, while extreme sizes reach 25 and more pounds. The excellent quality of its flesh causes it to be highly prized for the fresh market, but the color is too pale to suit the requirements for canning, although it is said that small quantities have at times been prepared in that way. It does not seem to be as plentiful as any of the species of true salmon, or at least does not congregate in such defined schools in the salt water, and in other respects its habits are evidently also quite different. It appears to ascend the rivers in small numbers during an extended period, but the main run begins in November and continues through more or less of the winter. The species is not captured abundantly at sea unless it be in a few places, the principal fisheries being carried on in the rivers and lakes during January, February, and March, when the fish are in excellent condition, but they subsequently deteriorate and are not in favor in the spring.

The steelhead will take the fly in the fresh water where it is clear, and are looked upon by the fishermen as especially ravenous feeders, not deserving of protection in a region where their presence is considered harmful to the young salmon of other species, especially the quinnat and sockeye, on whose spawning-grounds in the Fraser River they are reported to have been observed. The Canadian regulations, however, have greatly restricted their capture at the season when they could best be taken. The spawning season is said to be in the early spring, and possibly begins in the latter part of winter.

There is a sale for all the steelhead that are caught in the winter, and they are especially in demand for shipping fresh to the eastern and inland markets. This is largely owing to the firmness of the flesh, which permits them to be kept longer in storage in good condition than any other species, but as regards the quality of the flesh they do not occupy the first place. The total annual catch, however, has been relatively small compared with that of most of the other salmon. The fresh-water fishing-grounds are widely distributed, Sumas Lake being one of the most important in the Fraser basin. In Washington the principal fisheries are on the Skagit River, but in nearly all other rivers of any size the species seems to be taken in greater or less quantities.

According to the report of the State fish commissioner of Washington for 1898, this species has been the mainstay of a large portion of the Washington fishermen during the winter months, and the fishery has been fairly lucrative. The run, however, had on the whole greatly diminished, and the output for the present season, from the best information possible, is not 50 per cent of what it was two or three years ago.

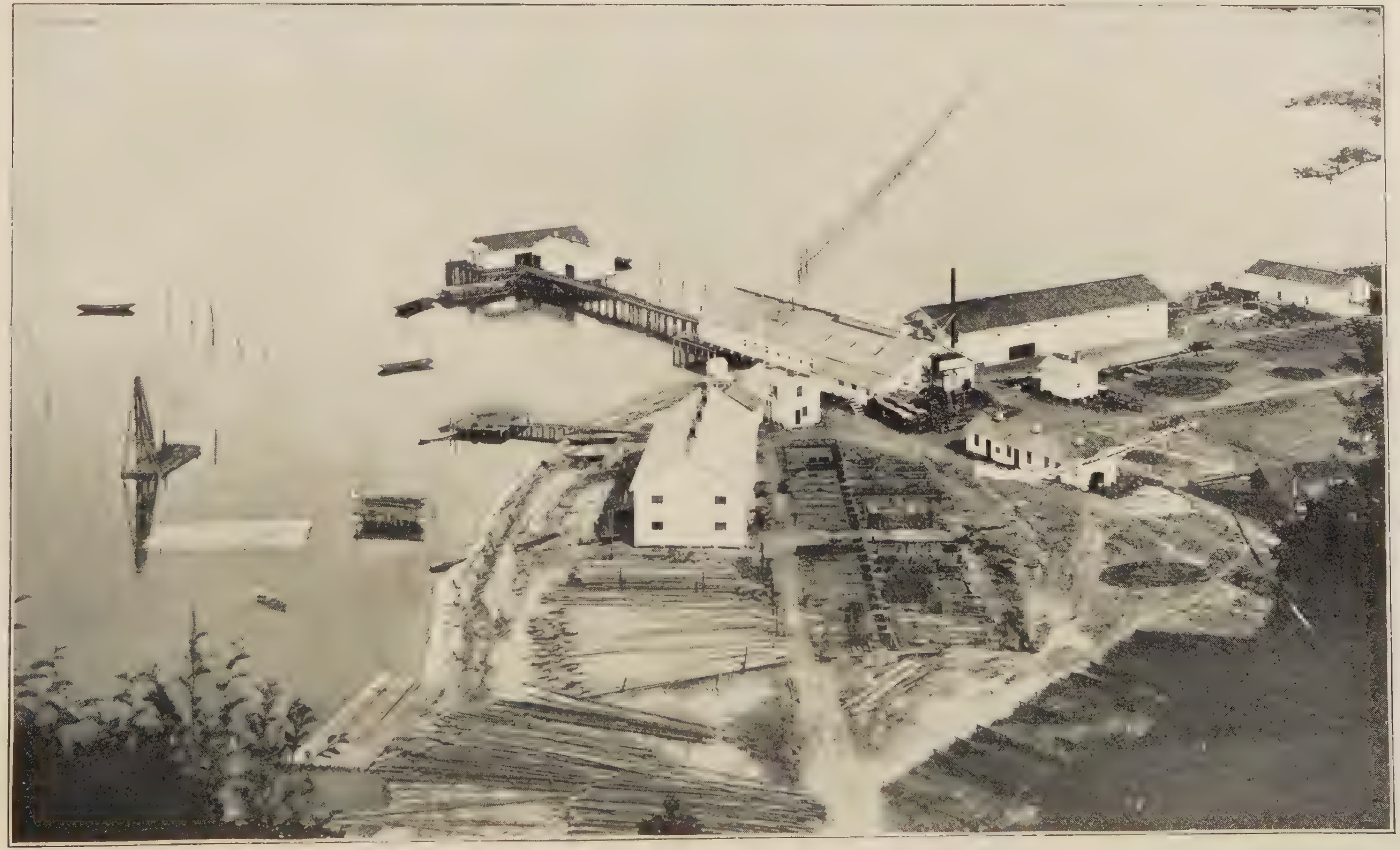
SALMON FISHING.

The Indians were fishing in this region when it was first invaded by the whites. They were then, however, solely concerned in supplying their own domestic wants, using apparently the same appliances they do to-day, reef nets and hooks and lines in the salt water, and spears, dip nets, and weirs in the rivers. Traders reached the upper Fraser very early in the century, thence working to the sea, and the salmon became one of their most important foods, being obtained partly by their own efforts and partly of the Indians. The latter gradually developed into commercial fishermen, and to-day constitute a prominent element in the fishing fraternity.

The white man's fishing seems to have been first definitely organized in British Columbian waters, as exemplified by the Fraser River, where its growth has been most rapid and systematic, and where its extent is probably still the greatest. Under Government supervision its methods there have practically been restricted to the use of a single form of apparatus, the drift net, which is especially adapted to the conditions prevailing where fishing is most actively carried on, and which also provides that the industry may be shared by the greatest number of individuals.

There is less definite information regarding the history of this subject south of the boundary line, although the whites possibly began fishing in the salt waters, where their catches have chiefly been made, some time during the sixties. Their methods have become much more diversified than in British Columbia, but it is only within about a decade that their industry has attained prominence. Their output seems destined very soon, however, to outstrip the Canadian fishery in amount and value, if it has not already done so at the time of writing. Fishing on a greater or less scale is carried on throughout most of the salt waters of Washington, but extensive operations are mainly concentrated in a few localities, as about Point Roberts, in Skagit Bay, and in the upper part of Puget Sound. Trap nets have become the most important means of capture. Before their introduction purse and drag seines and gill nets were the principal appliances and they are still used. There is some hook-and-line fishing, and reef nets continue to be employed by a considerable number of Indians.

In the Strait of Juan de Fuca there is comparatively little fishing for salmon. Small quantities are taken about Becher Bay, on the Vancouver Island side, chiefly by Indians, who also fish at the outer entrance of the strait, off Cape Flattery and Neah Bay, where one or more species are said to be sometimes quite abundant. On the south shore fishing in a small way, mainly for the fresh market and local use, has been carried on for some years, seines, gill nets, and hooks and lines being used. It is engaged in by both whites and Indians, who operate at several places along the coast, and also to a slight extent in the Elwha and Dungeness rivers. The sockeye is not known



CANNERY POINT, POINT ROBERTS, WASHINGTON, 1895, SHOWING THE CANNERY ESTABLISHMENT AND THE STRING OF THREE TRAP NETS EXTENDING OFF FROM THE POINT.

to appear on this shore, but all the other species are reported to be taken.

Point Roberts has figured most conspicuously in the Washington fishery, and the largest catches have been made in its vicinity. The principal reef-net ground of the entire region lies directly off its southeast corner, a large kelp-covered ledge, to which the Indians have undoubtedly resorted for many generations, and which has always been the cause of much contention among the several neighboring tribes. The perpetual right to fish upon it, in common with other inhabitants of the territory, was secured to the Indians by treaty with the United States in 1855, and while formerly regarded solely in the light of a rich collecting-ground, where their own needs could readily be met, it afterwards became the source of much revenue in their dealings with the whites. So far as the records show, the Indians have at no time resided permanently on Point Roberts. It has been their custom to be present there only during the fishing season, chiefly of the sockeye salmon, from about July 1 until early in September. In recent years their number has varied from 150 to 200, though sometimes reaching 250. Their canoes in active operation have been as many as 15 to 20, but lately the number has greatly fallen off through the intervention of the whites. Their drying racks formerly covered a considerable area, but they are now small in extent and have been entirely driven from Cannery Point, their principal location in more prosperous days. After the completion in 1894 of the continuous line of traps commanding the approaches to the big reef, its value for reef-net fishing seems to have been in great part destroyed, and the Indian catches declined so much in consequence as to render the old-time occupation practically unprofitable. The primitive methods are making way for those of civilization, and the process has not been wholly devoid of certain elements of injustice, which are by no means peculiar to this locality.

While the visits of the Indians to Point Roberts have had reference mainly to the salmon, they were at one time in the habit of going there in March, during some years but not continuously, in search of dogfish, of which they are said to have secured large catches. Those who went at that time might remain until the salmon season opened. They made use of a rude sort of gill net set along the flats, in which the dogfish became entangled, and also of trot lines having perhaps from 150 to 200 hooks apiece.

The Indians have also taken sturgeon in Boundary Bay, have fished there with hook and line in the fall for the silver salmon, and have used, by drying, the large clams which are very abundant along its shores.

There are no authentic records of the earlier fishing by the whites about Point Roberts, though it is well known that they were attracted there many years ago by the abundance of the salmon. In the beginning, however, it is probable that their supplies were chiefly obtained by purchase from the Indians. During the period when the Hudson Bay Company was active on the west coast, agents of the company made annual visits to the Point for the purpose of adding to their stock of salmon. In the early sixties, according to one informant, who has had a long experience in the region, several men were engaged in fishing and purchasing at the Point in a small way. There was, however, little expansion in the work for over a decade, and practically not until about 1875, when parties from Seattle went there to engage more regularly in the business, which then consisted chiefly in salting and barreling fish. The canneries on the Fraser River also began to obtain some of their supplies from this locality, but apparently never in large quantities.

The Indians furnished a part of the salmon; the remainder were taken in drag seines measuring about 100 fathoms long by 35 feet deep and with a 4-inch mesh. From 4 to 6 of these seines were in use from about 1875. The seining-grounds were on the west side of Point Roberts, extending northward from the southwest corner a distance of about 1½ miles, where the shore is free from stones and well adapted to the purpose. These nets were operated during the sockeye season, and later for the silver salmon, which species was taken in the greater abundance. Humpback salmon could be secured in large numbers, but they had no sale and were only used by the Indians. The quinnat were never fished for, as they ran too early in the year, when the weather was still stormy. Purse seines have also been employed about Point Roberts for some years, and are still used there to some extent.

There are no figures showing the catch during this period, but it is said to have fluctuated greatly, dependent upon the abundance of the fish and the number of men at work, the latter having varied from year to year. Between 1875 and 1889, according to the accounts received, the maximum number of whites present in any season was about 30. In some of those years the output would not have exceeded 450 barrels of salted salmon, while in others it reached as many as 3,000 barrels. This was in addition to what might have been sent to the Fraser River.

Fishing on a greater or less scale is carried on in most of the Washington rivers which empty into Puget Sound and the Gulf of Georgia. The Skagit is the principal of these rivers, and is especially noteworthy as the resort of the sockeye as well as of all of the other species of salmon. The runs are relatively large and excellent opportunities for fishing are thus afforded. Previous to 1893, however, most of the catch, such as it was, was disposed of locally to ranchmen, mill hands, and settlers, but in the year mentioned it is said that 300,000 pounds of salmon from this river were sold to the markets in Seattle. These were caught between Sedro and the mouth of the river, and consisted in large part of quinnat and steelheads. The number of fishermen was about 50, of whom perhaps one-half made this business their regular occupation. Above Sedro, including Baker River, the catch during the same year, reported to have been about 136,000 pounds, was still entirely utilized by the inhabitants of the neighboring country.

Nets were employed up to 1893 only in the main Skagit River. They were mostly gill nets of two kinds, one being set, the other drifting when in use. The same year two seines, 100 fathoms long and 30 feet deep, with a 3-inch mesh, were operated at La Conner at the mouth of the river, and in the same neighborhood the Indians had four seines of the same mesh, 30 fathoms long and 10 feet deep. A salmon wheel was also built in that year a few miles below Sedro, but the results were not satisfactory. Nearly all of the salmon taken in its two branches, the Baker and Cascade rivers, up to 1893 were obtained by means of spears and gaffs, both whites and Indians resorting to this method.

The recent rapid development of the salmon market at Seattle, the establishment of canneries at Anacortes, and the demands from canneries at more distant places have given a fresh impetus to the fishery in both the Skagit River and the bay of the same name into which it empties. In the latter especially has there been a marked increase in the amount of apparatus employed, which consists of trap nets, gill nets, and seines.

The Nooksack River is also, in proportion to its size, becoming of considerable importance as a salmon stream. The sockeye have been said to enter it, but the evidence to that effect is not conclusive. Fishing is carried on directly off the mouth of the river as well as at several places along its course. Gill nets have been chiefly employed, and it has been proposed to introduce trap nets near the mouth.

The salmon fishermen on both sides of the line are of many nationalities, most maritime nations of Europe being represented and also the Japanese. A large proportion consists of Indians and half-breeds, and some negroes are also employed. The Chinese, however, while they compose the bulk of the help in the canneries, have participated only to a very slight extent in the fishing and not at all in Canadian waters. Nearly if not quite all of the trap-netters are whites.

TRAP NETS.

The use of trap nets in this region has been restricted almost exclusively to the United States and mainly to the capture of the sockeye salmon in the clear salt waters, where no other kind of apparatus seems to be so well adapted for taking this species in the large quantities required by the canneries. With the few exceptions elsewhere noted, therefore, we find these nets distributed only along the course taken by the sockeye on their passage from the sea to their spawning rivers. They have not been tried in the Strait of Juan de Fuca, however, nor does it seem probable that the sockeye schools skirt the shores of that channel closely enough to give occasion for their employment at any place unless it be in the vicinity of Becher Bay, on Vancouver Island.

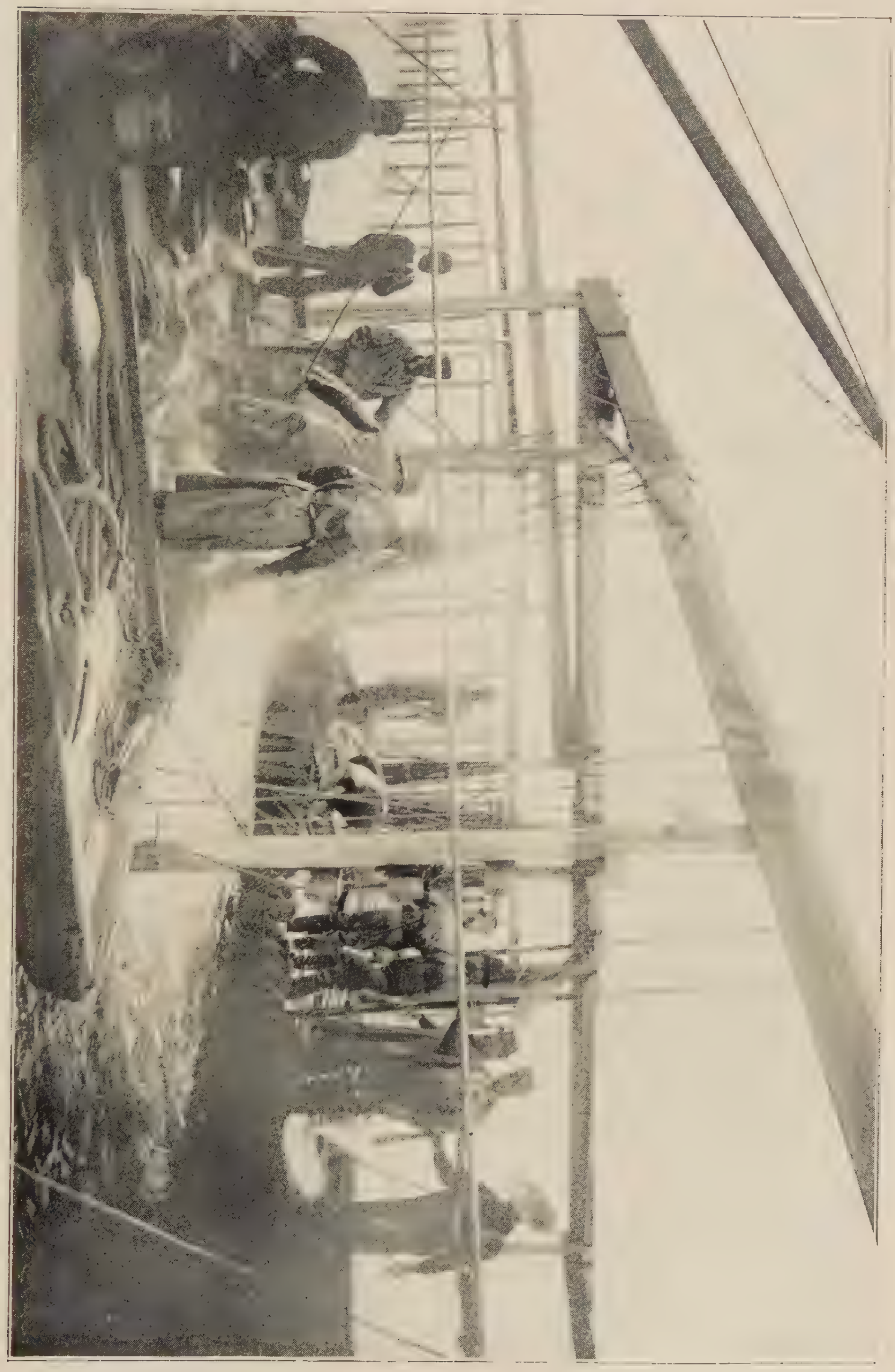
The first locality in the pathway of these fish where profitable trap-net fishing has been found is at the southern end of San Juan Island. Of the schools which turn southward after passing the San Juan group, the only ones recognized commercially are those which enter through Deception Pass into Skagit Bay and River. Trap nets have been used in Skagit Bay for several years, but the catch there also consists in large part of silver salmon and the quinnat.

As the main body of the sockeye moves northward through the Canal de Haro and Rosario Strait, the finest opportunities for the capture of this species are to be expected in that direction. In the former passage, however, no successful trap-net sites had been discovered up to 1896, although trials had been made at Henry and Stuart islands and probably elsewhere. In Rosario Strait, moreover, good fishing with these nets has heretofore been found only in the vicinity of Village Point, on Lummi Island. Trials have been made along the mainland shore north of Lummi Island, but the principal trap-net grounds of the region, and the last before the boundary is reached, are those furnished by Boundary Bay and the waters about Point Roberts. In this locality traps have been in use the greatest length of time and in the greatest number, while their catch has exceeded many times that of all the other similar nets combined.

The Canadian government has constantly opposed the placing of trap nets in British Columbian waters, although much pressure in favor of their construction has been brought to bear. In 1894, however, it yielded to the extent of permitting the building of one such net in Boundary Bay, the number being increased to two in 1895. Taking into consideration their position in the upper part of Boundary Bay, where any fish they might intercept would be headed toward the group of nets in the adjacent waters of the United States, this concession can not be regarded as inconsistent with the general policy of the Canadian government in the matter of this class of fishing. The position of these nets, however, is unfavorable, and it is doubtful if they can be made to pay, especially in view of their distance from the Canadian canneries. Except for a sort of fascine arrangement tried unsuccessfully in 1877, no traps have ever been used on the lower Fraser, and the quantity of sediment and drift brought down by the current would probably interfere with the proper working of such apparatus.

The total number of traps in operation during more or less of the season of 1895 was 21, but not nearly all of these are known to have made good catches, especially of sockeye, and several were practically failures. Twenty-nine additional trap-net sites which had been tried in previous years, but had been abandoned for one cause or another, were definitely located the same year by the Fish Commission party, but the actual number of such sites must have been much greater. New traps were added in several places in 1896, 1897, and 1898, but their exact positions have not been learned. The total number in 1898, however, was much greater than in 1895. The future growth of the fishery can not be predicted. Despite its rapid development it has met with many reverses, and much capital has been sunk. Only a certain proportion of the nets have realized the expectations of their builders, and the location of successful sites has, in most cases, been the result of actual trial, generally following one or more failures,

PLATE 11.



REMOVING SALMON FROM TRAP NET OFF CANNERY POINT, POINT ROBERTS, WASHINGTON, 1895. TO SHOW HEAVY CONSTRUCTION OF THE CRIB IN THE LARGE TRAPS.

as little reliance can be placed upon the existing knowledge of the movements of the fish. How the growth of the industry may affect operations on the Fraser River and the abundance of the sockeye is also an important matter which remains to be determined.

CONSTRUCTION OF THE TRAPS.

The salmon trap nets are constructed on the same general principle as the pound nets of the Great Lakes, consisting of a crib, tunnel, heart, and leader; but they are usually made of a larger size, and experience has dictated some important modifications. The netting is of cotton twine, and is supported by wooden stakes driven into the bottom. Wire netting of galvanized iron, in place of the cotton, for the hearts and leaders, has been suggested as probably more durable, and experiments regarding it have recently been carried on at Point Roberts. Floating traps, such as are successfully employed for salmon and other species in the Gulf of St. Lawrence, have never been tried in this region, but their relative cheapness and the ease with which they can be shifted from place to place are advantages which might commend them to the fishermen of Washington.

The fishing-sites in the track of the sockeye are largely in exposed positions, many of them being open to the full force of any gale sweeping across a wide expanse of water from more than one direction, as is especially the case at Point Roberts. This condition necessitates the building generally of stronger traps than are customarily used in other regions. The stakes are unusually heavy and are often backed by additional piling. The crib, moreover, is frequently strengthened by a capping of timber which binds the stakes together, and this capping may be continued along the top of the heart and even of the leader to a greater or less distance. This construction gives the appearance of great permanency, but it is designed only to meet the requirements of a single season, and it sometimes fails even in this respect, especially if the season be a stormy one. While some of the upper timbers and the netting may be saved, the stakes are seldom, if ever, available for a second season. The latter are rapidly honeycombed by ship-worms and it is not the practice to remove them. They are liable to break in the attempt to pull them from the bottom, and in the course of two or three months they become so thickly covered with barnacles as to chafe the nets badly.

The length of the leader varies according to location and the slope of the bottom, but it is generally much greater than in the Great Lakes, sometimes exceeding a half mile. The cribs are also generally of extra size, rectangular, but not always square in shape, and measured in the several traps examined from 35 to 80 feet on a side. Their depth ranged from 3 to 9 fathoms, dependent upon the depth of water. The hearts are, as a rule, proportionally large for the size of the crib, are sometimes double, one leading into the other, and constitute the most novel feature of the trap. They vary greatly in shape to meet the supposed exigencies of each locality, and often have a leader-like extension of greater or less length, the entire arrangement being planned to intercept and direct toward the crib-opening such of the salmon as do not follow close along the main leader, and to minimize the chances of escape of those which have entered. This construction, the outcome of much experimenting, is said to have very greatly increased the effectiveness of the traps.

There may be an opening into the heart and crib on both sides of the leader, but it seems to be the more common practice to limit the entrance to one side, at least as regards the fishery for the sockeye, in view of the steady and constant movement of this species in one direction while on its passage to the fresh waters. The customary double opening would offer no advantages under these conditions.

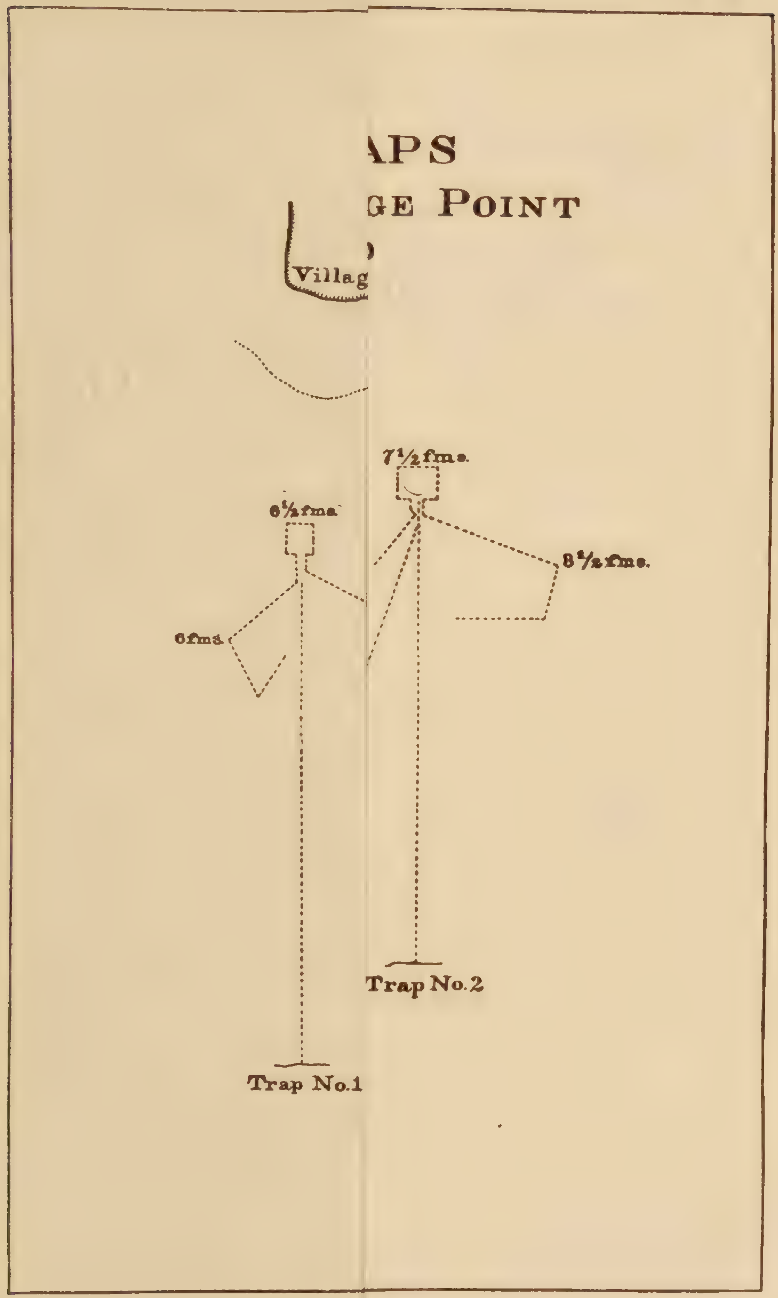
The mesh of the netting is usually 3 inches in the crib and heart, and from 3½ to 4 inches in the leader. Mesh of larger size, from 6 to 8 inches, has been tried in the leaders, but it is said to have proved disadvantageous, owing, in part at least, to the large quantity of coarse seaweed which is often found floating in the water, and which finds lodgment in the larger mesh, tending to clog it and weigh down the net. Observations on the general effect of using the smaller mesh in both the crib and leader are lacking. The gill-net mesh for sockeye on the Fraser River is 5⅞ inches, and it would seem that the mesh in the crib might be increased above 3 inches without danger of gilling adult fish. There would be no object, however, in taking such a step, unless it were found that the present mesh was destructive of young salmon or of other species smaller in size than the sockeye. This fact could readily be determined by careful examination extending through an entire fishing season.

As elsewhere explained, the catches made in the trap nets are sometimes much larger than can at once be handled by the canneries, and while one such catch might be held in the crib for several days, it would prevent continuous fishing during a period when the salmon might be running best. To meet this contingency an adjunct to the crib, called a spiller, has recently been devised, and appears to be coming into quite general use. It is, in fact, an additional crib, square in shape, and connected with the first by means of a tunnel, through which the surplus fish of any catch may be driven. In this way large numbers of salmon may be kept in good condition for a considerable time, fishing may go on uninterruptedly and without loss, and the canneries continue in operation during intervals when the runs are small or have ceased.

DISTRIBUTION AND HISTORY.

The shores first approached by the sockeye which have furnished sites for trap nets are those of the San Juan Islands, but none of these has so far been more than very moderately successful. How many trials have been made there as well as elsewhere throughout the region it has been impossible to ascertain. In 1894 two nets of this character were built on Lopez Island. One was near Fisherman Bay, in San Juan Channel, where it is now thought the sockeye never enter, or, if at all, in

PLATE 12.


APS
GE POINT
Villag
7½ fms.
6½ fms.
8½ fms.
6 fms.
Trap No. 2
Trap No. 1

quantities too small to be appreciable. The other was off the south side of the island, in the vicinity of Long Island, where sockeye were observed in 1893, though they failed to appear, or at least to be taken, in 1894. The same year there was a trap at Reed Harbor, Stuart Island, which also proved unsuccessful, and none of these three places has since been tried.

In 1895 there were again apparently only three traps among these islands, one of which was on Henry Island, near Roche Harbor, but as the site was evidently unfavorable for the purpose it was soon abandoned. The other two were located off the south side of San Juan Island, just west of Cattle Point light-house. The eastern one was built on the northwestern edge of Salmon Bank, the other being about three-fourths of a mile farther west. The western began near the beach and extended off a distance of about 3,200 feet, while the eastern started some distance from shore and had about 2,900 feet of leader. The extreme depth of the cribs was about 7¼ fathoms. It is said that the western net took but few sockeye, although the eastern did fairly well. Many humpback salmon and small quantities of other species were also caught. It was proposed in 1896 and 1897 to increase the number of traps among the San Juan Islands, but no definite information as to the sites occupied has been obtained.

As to the waters directly east of the San Juan group, trap-net fishing has been mainly limited to Skagit Bay and Lummi Island. In 1895 there were two traps in Skagit Bay, both of moderate size, one being operated at Demock Point, the northwestern extremity of Camano Island, the other at Hunot Point, near the southern end of Fidalgo Island. In previous years the following sites, as well as others, had been occupied: Alaki Point, at the northeast end of Whidby Island; the west side of Kiket Island; Tosi Point and Hunot Point, on Fidalgo Island; and the shore between La Conner and Goat Island. The traps in Skagit Bay are placed to intercept the run of sockeye which, entering through Deception Pass, are making for the Skagit River. Silver salmon and the quinnat are also taken here in abundance, and supplies are shipped to canneries in other places as well as to the fresh market at Seattle. By 1897 the number of traps in operation had been increased, and the industry had assumed much greater importance owing to the establishment of two canneries at Anacortes.

One small trap net was reported to have been fished in 1895 near Edison, in Samish Bay, and another was projected for William Point, Samish Island, in 1896. It was not learned for which species these nets were planned.

On the west side of Lummi Island, south of Village Point, three trap-net sites, about equal distances apart, had been occupied up to the close of 1895, the farthest being about 1¼ miles from the point, the nearest within one-fourth mile. They lead off from the shore from 637 to 725 feet into depths of 6½ to 8 fathoms. One was built upon for the first time in 1895, but the others are of older date. One of the latter, the farthest from the point, has been abandoned. The remaining two, however, are said to be favorably placed, but while both were put to use in 1895, an injunction obtained against them by the Indians prevented their employment during most of the season. This was due to their location inside of and adjacent to one of the favorite reef-net fishing-grounds, which the Indians claimed was being injured by their proximity. Here also, in 1897, a marked increase was shown in the extent of trap-net fishing.

An elaborate trap built in 1894 at Sandy Point, on the mainland, a short distance north of Lummi Island, is reported to have taken no sockeye; but while the site was not occupied in 1895, it was proposed to utilize it again in 1896. Projected traps for 1896 were also to be located at Cherry Point and Point Whitehorn, still farther north, on the mainland. One was erected in 1895 at Birch Point, but was used for only a few days. It was intended to rebuild it on a larger scale in 1896.

Point Roberts.—The advantages of the waters about Point Roberts for trap-net fishing will be understood from the account of the movements of the sockeye after reaching Boundary Bay. The number of fish which pass around the point and the regular course taken by the schools combine to make this locality, as regards the species named, the most favored of any in the salt waters of the region.

Point Roberts is about 3 miles wide along its southern shore, which is nearly straight, and between 4 and 5 miles long north and south, about 2 miles in this direction lying south of the international boundary line formed by the forty-ninth parallel of north latitude. On the east side it is bordered by Boundary Bay, which, including Semiahmoo Bay, has an extreme width of about 11 miles. North of the boundary this bay is very shallow, being nearly everywhere less than 3 fathoms deep. The width of the shallower water narrows in the direction of the southeastern corner of Point Roberts, known as Cannery Point, south of which, however, there is an extensive kelp-covered ledge, long a favorite fishing-ground of the Indians. After passing this ledge the 3-fathom curve lies close inshore along the south side of Point Roberts and until after rounding its southwest corner, when it again bends offshore quite abruptly as the broad bank off the mouths of Fraser River is approached.

The facilities for the building of trap nets in this locality are mainly determined by the contour of the bottom. The shallow water off the east side of the point gives opportunity for greatly multiplying their number, but when the depths are slight, the conditions are generally least favorable for the movements of the sockeye, and much of the ground is practically valueless. More fish are said to be taken along the edge of the deep water than elsewhere, and those nets fish best which are in the deep water or lead into it. The winds also are a factor as regards the shallow areas, as the nets up in the bay do nothing when there is a northwest wind, while a southerly wind, blowing on the shore and causing rough water, seems to drive the fish in. Cannery Point is considered to present the best advantages yet discovered, and much larger catches of sockeye have been made directly in front of it than in any other part of the salt water. Along the south side of Point Roberts long leaders are not possible, and the cribs are invariably comparatively near the shore, but the fish also keep correspondingly farther in, and after Cannery Point the next best sites are said to be in the neighborhood of the southwest corner. West of the point, up toward the boundary line, the bottom is again suited to long leaders.

Trap-net fishing was started at Point Roberts some years before it was taken up at other places. The first net of this kind was built by John Waller, about 1880, off Cannery Point, a short distance north of the Indian reef, and this position appears to have been more continuously occupied for the purpose than any other. For nearly a decade, however, such operations as were carried on were scarcely more than experimental, and the results for the most part were small. While we have little information on the subject, the traps as first constructed seem not to have been entirely suited to the capture of the sockeye, and the value of the different sites had yet to be learned. In Waller's trap the crib is said to have been only about 20 feet square, while the leader, measuring some 900 feet long, did not approach nearer than 300 feet from the shore. It was set only during the sockeye run, the greater portion of the catch being sold to the canneries on the Fraser River, while the remainder were salted. Mr. Waller was succeeded about 1885 by a practical fisherman from the Great Lakes, who is still at Point Roberts and who has done much to bring the net to its present state of perfection. He made use of at least the same general position as Mr. Waller, but in 1887 a second trap was added on the eastern side, much nearer the boundary line. Until 1891 the number of these nets does not seem to have been increased beyond two, the catch by this means continuing small and being disposed of as in the beginning. In the last-named year, however, a small cannery, the first one in the region, was built at Semiahmoo, at the eastern end of Boundary Bay, and arrangements were made to obtain the necessary supplies of fish from Point Roberts. This led to the erection of one or two, possibly three, additional traps. In 1893 a second cannery was built, this one occupying the southeast corner of the Point, and the number of traps was increased to 13, 11 being operated by the two canneries, and 2 independently. Before the next season both canneries had passed into the control of the Alaska Packers' Association, which made use of 12 traps during 1894, while 4 were under independent management, making 16 in all south of the boundary line. During this year the first net was placed in the Canadian waters of Boundary Bay, being located close to the line.

In 1895 there were 33 trap-net locations about Point Roberts, of which 23 were east of the Point in Boundary Bay, and the remainder south and west of it. This number included both the traps in use and those of previous years whose positions were still marked by more or less of the old and generally much decayed stakes. One object in leaving the latter in place, besides the trouble and expense of removing them, was to show a preemption of the grounds they occupy, and thus, as far as possible, to prevent encroachment by outsiders. The better sites, to the extent that they have been disclosed or that a foothold could be gained, are the ones now occupied, and the good grounds seem already to be pretty thoroughly controlled by those in possession, although further experience may suggest other profitable locations. The extent of fishing at this point, however, will probably continue to be largely regulated by the capacity of the canneries near at hand, or rather by their output as dictated by market conditions, unless competition should arise to stimulate an active rivalry.

Eleven traps were in operation to the east of Point Roberts in 1895, two of these being in Canadian waters and the majority of the others directly off Cannery Point. Seven were controlled by the canneries at Point Roberts and Semiahmoo, while the catch from the remaining four was disposed of on the Fraser River. These traps were irregularly distributed to a distance of about 2 miles from the shore of the Point, three being united in one continuous string and two in another, the remainder being placed singly. The string of three traps extended off from the shore of Cannery Point in a southeasterly direction a distance of about a mile, paralleling the northern edge of the Indian fishing-ledge elsewhere described. The inner trap had a length of about 2,500 feet, the second of about 1,500 feet, and the outer one of about 1,000 feet. The cribs were large and were located successively in depths of 5½, 6½, and 7 fathoms. In none of the other traps on the east side did the inner end of the leader approach near to the land, and in most cases it was a considerable distance off, while the depth of water at the several cribs ranged from 3 to 8½ fathoms.

The direction given to the leaders is based upon the experience of the fishermen that the sockeye appear to enter Boundary Bay well to the east, make a broad sweep westward and then turn somewhat abruptly southward so as to pass out quite close to Cannery Point. The leaders in the outer and northernmost traps may extend north and south, but they generally deviate from this course so as to trend more or less northwest and southeast. Farther west and south, however, they usually run more nearly east and west, but never exactly so, and altogether there is a very great variation in the direction given them. The Canadian nets are rather out of the course of the sockeye, and their catch is largely dependent on the direction of the wind, which is also the case with the more northern nets south of the boundary. The expense of transporting fish to the Fraser River also works to the disadvantage of the Canadian nets.

The two traps in operation off the south shore of the Point in 1895, both single ones, were situated near its southwest corner, which is considered to offer the best advantages next to Cannery Point. The abrupt slope of the bottom in this locality necessitates the use of short

leaders, not exceeding 1,800 feet, which begin near shore and extend into depths of 5½ and 7 fathoms. Off the west coast there were also only two single traps in 1895, both being well up toward the boundary, and off shore. They had comparatively long leaders extending over the edge of Roberts Bank, the cribs being located in depths of 6½ and 9 fathoms, respectively, and at distances from shore of about 3,200 feet and 1½ miles.

In 1897 and 1898 many additional trap nets were in use about Point Roberts, but their number and exact location have not been ascertained. The catch of sockeye in the former year was very large, and the capacity of the region was shown to be much greater than had been anticipated.

SEASON AND CATCH.

The canneries obtaining their supplies at Point Roberts desire only sockeye salmon, and take other species only when the sockeye catch is insufficient to meet their requirements. The trap nets at that place are therefore built almost exclusively for the capture of the sockeye, and, in view of the expense attending their construction and maintenance, it is doubtful if any would be used there except for the presence of this species. The season when they are set is mainly limited to the period during which the sockeye run continues, generally beginning between the first and middle of July and closing between the middle and end of August.

In 1894 and 1895 one or two traps are said to have been set for the quinnat salmon, commencing between the 10th and 15th of June, but as the weather about Point Roberts is likely to be stormy as late as that time, the risks attending the working of the traps have discouraged their use during the quinnat season. To maintain an active spring fishery for the quinnat by this means would require a special strengthening of the nets, increasing the expense, while at the same time there would be constant danger of their serious injury or destruction. The prevailing summer winds are northwesterly, but easterly winds occasionally occur, producing rough water in the neighborhood of the nets in Boundary Bay and making it difficult or impossible to lift them for a day or two, especially the more northern ones in the shallower water. If the sockeye season has been unfavorable, a few of the traps may be left in position during a part of September, in order to cover more or less of the run of silver salmon in case it is desired to fill out the pack with that species.

As an indication of the recent rapid growth of the trap-net fishery at Point Roberts, it may be noted that in 1892 the catch of sockeye by that means was reported as about 37,000 fish, while in 1895 it had increased to about 680,000 fish, of which by far the greatest quantity was taken in the nets of the nearby canneries. The number of spring salmon caught during the latter year was reported at less than 5,000. Humpback salmon are taken in connection with a part of the sockeye run in very large quantities, but they are seldom, if ever, used for canning.

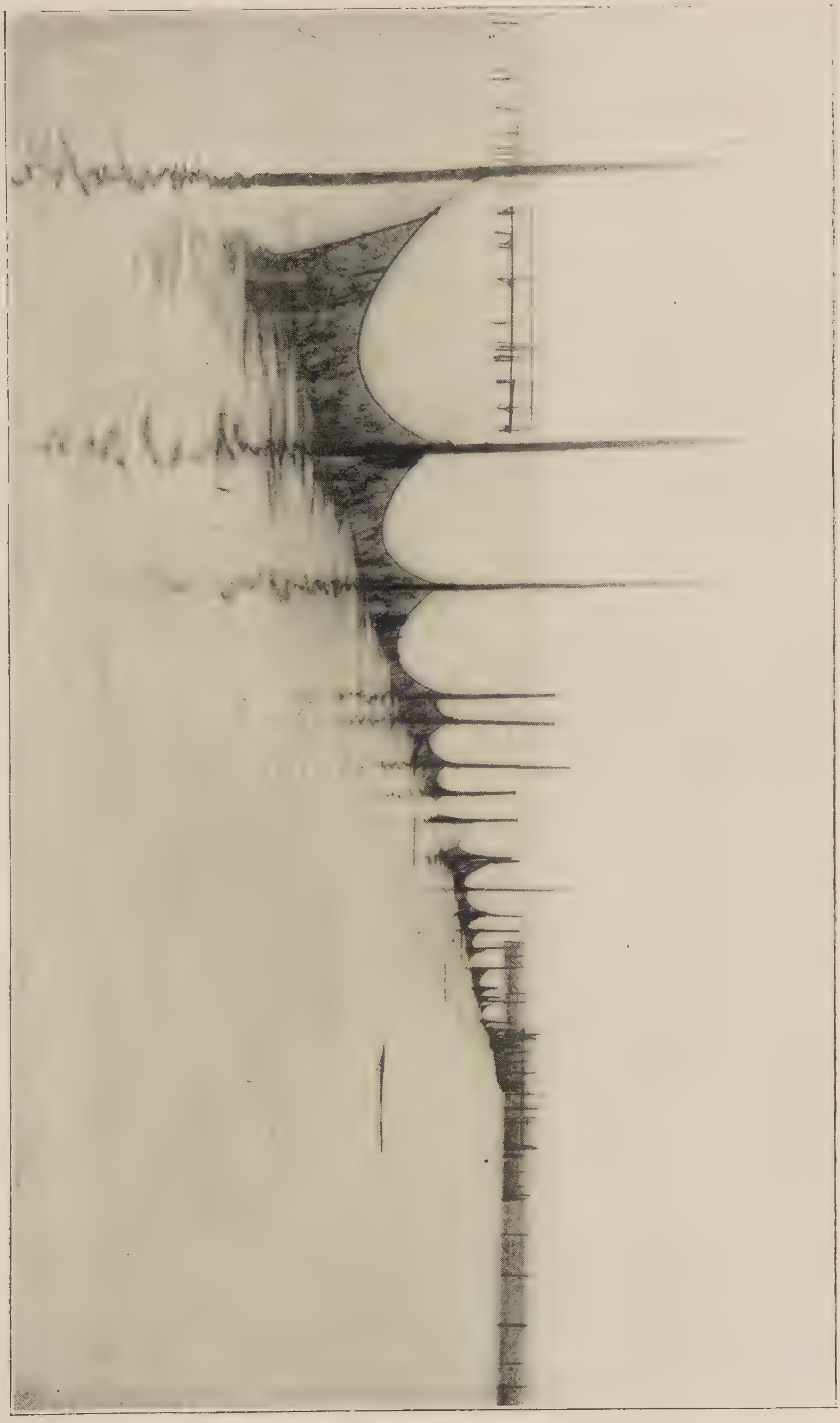
Before the building of canneries at Semiahmoo and Point Roberts the Fraser River furnished the only market for disposing of the fish in fresh condition; but the establishment of canning operations near the location of the traps has changed all this. In 1895 the river canneries received out of the total catch of 680,000 sockeye only about 80,000, of which 30,000 came from the nets in the Canadian waters of Boundary Bay and 50,000 from three nets south of the boundary line. In good years, when the Fraser River catch is ample, there has been no need to draw on Boundary Bay, although contracts previously made may have to be carried out, while in poor years there is a desire to retain at Point Roberts as much as possible of the sockeye catch made in that vicinity. The Fraser River canners are, as a rule, opposed to handling sockeye from Point Roberts, except in cases of emergency, for the reason that the fish are apt to deteriorate greatly in condition during transportation, when they are piled in large scows and towed from the fishing-grounds to the canneries. The season, being the height of summer, is unfavorable, and the fish are often so soft upon reaching their destination that no use can be made of them. This happens most often in years of large catches, when the competition for markets is very great, and when the loss of fish from this cause has sometimes been very heavy.

There is a marked inequality in the size of the sockeye catch at Point Roberts, as in other localities, from time to time during the same season, due to fluctuations in the abundance of the fish, as elsewhere explained. Small catches for a period may be followed by excessive ones (amounting occasionally, it is said, to from 40,000 to 50,000 sockeye in a single day by the principal nets at Point Roberts), the latter sometimes causing a surplus which the canneries can not utilize immediately. In this respect the trap nets possess an advantage over the gill nets, in affording the means of releasing or keeping the fish alive, through the crib itself or the spiller. The practice has also been followed of removing the surplus catch to cold chambers awaiting use.

Notwithstanding the special advantages which the traps present in this respect, there is what seems to be well-founded complaint of the waste of many fish through their means, including even the sockeye in seasons of great abundance. The charges recite that this species is sometimes retained in the nets until no longer fit for use, and also that at times only a small proportion, the choicest parts, of each fish are utilized for canning, the remainder being rejected. As it is difficult to imagine the willful destruction of so valuable a fish simply, as it is claimed, to prevent their coming into the possession of others, it is to be hoped that the circumstances are not so bad as represented. The danger of the extermination of the species is too great to justify a resort to any such methods and most stringent measures should be adopted to prevent a waste in this direction.

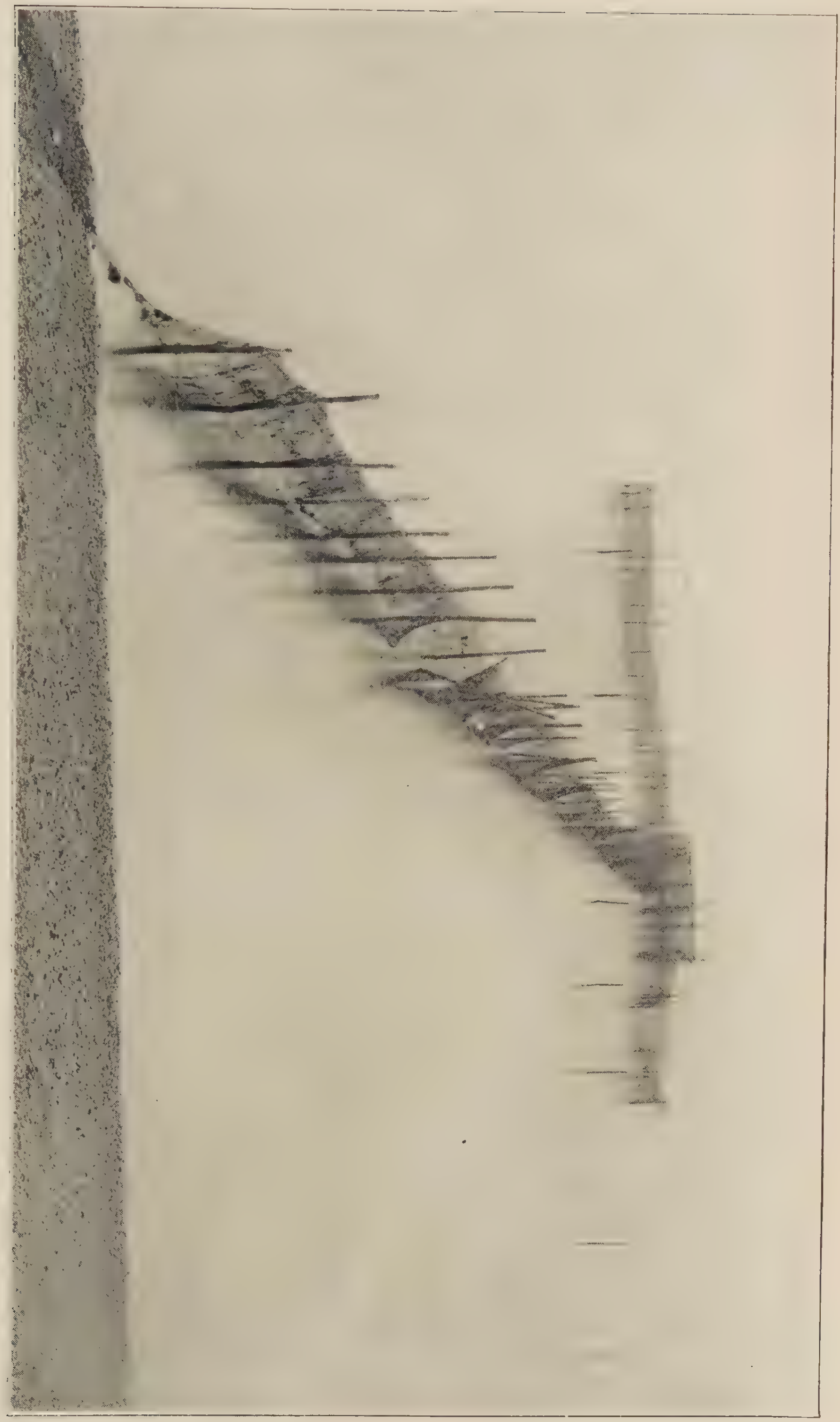
The principal destruction is probably of other species of salmon and of fishes belonging to other groups, which are trapped in conjunction with the sockeye and in the removal of which no pains are taken to

PLATE 14.

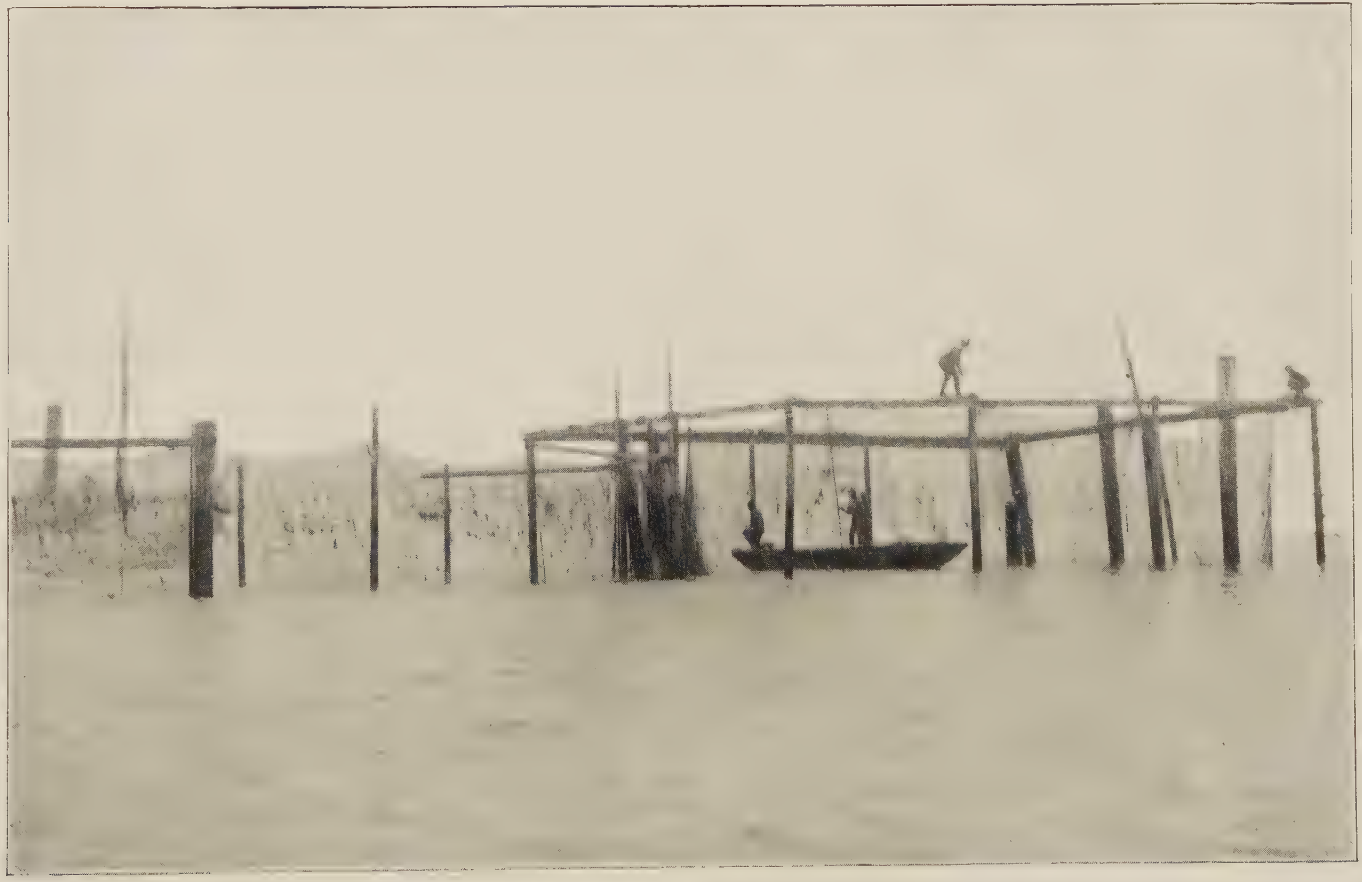


TRAP NET AT HUNOT POINT, SKAGIT BAY, WASHINGTON, 1895. SEEN FROM THE SHORE.

PLATE 15.



TRAP NET AT DEMOCK POINT, COMANO ISLAND, SKAGIT BAY, WASHINGTON, 1895. SEEN FROM THE SHORE.



CRIB OF TRAP NET AT DEMOCK POINT, COMANO ISLAND, SKAGIT BAY, WASHINGTON, 1895.

return them alive to the water. This results mainly from the large size, generally, of the catches and the difficulty of sorting them during the operation of emptying the crib. With the exception of some of the largest forms, it is customary to load everything on scows by means of large dip nets or by reversing the crib net, after which the desirable parts of the catch are selected out and the remainder thrown away—nearly all being dead by this time. Experience with trap nets in other regions shows that some discrimination can be made during the progress of removal, especially when the species to be saved are large and easily recognized, as is the case here, but in so doing the work is much prolonged and the expense increased. In a new region, so rich in resources as the one in question, where use can be found for only the choicer products and competition is exceedingly keen, it is questionable whether such exacting regulations of this character would be either wise or expedient at present. In fact, regulations looking to the release alive of any part of the catch of trap nets seldom contemplate in any region the assorting of the catch by hand, but only the escape of the smaller fish through proper restrictions upon the size of the mesh. This is a question which indeed deserves consideration in connection with the traps of the Puget Sound region.

Among the species said to be destroyed in quantity are the quinnat, when off color, humpback and other salmon, sturgeon, herring, smelt, and flounders. As it is not possible to determine the color of the quinnat until it has been cut, there seems to be no way of affording the protection which it equally lacks when taken by other methods. Dogfish, which are sometimes captured in large numbers, are returned alive to the water, and a sale is springing up for the sturgeon, though many have been wasted in the past.

GILL NETS.

BRITISH COLUMBIA.

Gill nets are the principal appliances of the salmon fishery in British Columbia, but in Washington they are less important than the traps and seines. In Canadian waters, in fact, commercial fishing for salmon with nets is restricted to the use of drift gill nets, except in the upper part of Boundary Bay, where traps have been allowed, and in one or two northern localities, where seining is permitted because of the clearness of the water. The drift-net grounds are mostly limited to the Fraser River and the adjacent part of the Gulf of Georgia, where the advantages for fishing are much greater than in any other section of this entire region. Not only does this river and its approaches have the largest runs of all the species of salmon, but during the most important months for fishing they present together an exceedingly large area of highly discolored water in which gill nets may be used as effectively in the daytime as at night. This discoloration, which results from the floods caused by the melting snows among the mountains, commences generally about the middle of April and lasts until early in the fall, thus covering a large part of the quinnat run and all of that of the sockeye. Before it becomes sufficiently marked to obscure the nets, the quinnat fishery is mostly carried on at night.

This drift-net fishery was being carried on in a small way as early as 1875 at least, but in the beginning it seems to have been entirely confined within the river. Finding, however, that good fishing by this means could be obtained outside the delta, the fishermen began by 1885 to resort to the "sandheads" off the south arm, from which point the area of their operations has been extended until by 1891 it reached as far offshore as does the intensely muddy water of the Fraser. Wherever this condition exists the sockeye can be taken in drift nets as readily and in as great abundance as in the river itself. This extension of the grounds has given opportunity for a greatly increased catch, and has caused the bulk of the fishery to be centered within a radius of 6 or 8 miles of the river mouth, upstream in one direction and out in the Gulf of Georgia in the other.

Drift-net fishing in the Fraser is restricted by law to that part of its course which is influenced by the tide, the upper limit being placed at Sumas River, between 50 and 60 miles above the mouth of the main river. Comparatively little, however, is done above New Westminster, though there are in this upper section a few good drifting-places during high water, where the quinnat are taken in the spring and the sockeye in July, but generally in August the river becomes so low as to interfere with operations. During a short period in each week of July and August, immediately following the weekly close time, drifting may be carried on largely about New Westminster and thence downstream, but as a whole by far the greater part of the fishery is limited to the lower 6 to 8 miles of the river and the outside grounds. This is explained by the fact that the current is not so strong below, there is more room and more certainty of a sailing breeze upstream to renew the drift, and competition naturally impels the fishermen to seek the grounds nearest to where the fish first appear, in their efforts to secure some advantage. The canneries have also become mainly concentrated along the lower part of the river, especially in the vicinity of Ladner, and at Steveston, where they are convenient to the fishing-grounds now mostly resorted to. Fishing is carried on in all three branches of the delta, the main channel, the North Arm, and Canoe Pass.

Outside the river there are no legal restrictions upon the extent of the grounds, their limits being solely defined by the opportunities for securing fish. As explained in the account of that species, the sockeye assemble in front of the delta, coming apparently both from the south and west, and occupying a considerable area both on and off the edges of the bank which stretches from Point Grey to Point Roberts. The discolored water permits the use of drift nets as far north as Point Grey, as far south as the boundary line, and to a distance of at least 5 or 6 miles offshore in the direction of Vancouver Island. The heaviest part of the fishing is done off the main entrance and Canoe Pass, toward which the fish are working, but during a trip from the delta to Point Roberts, at the height of the sockeye season in 1895, the boats were observed to be also scattered elsewhere in all directions as far as one could see, to near the boundary line, south of which they do not go. There were at least 400 or 500 boats outside on that occasion, and the scene presented was one of great animation. While the nets are set with reference to the current, they soon take devious courses, and in places were so close together that the tug on which we were had difficulty in picking its way among them.

Owing to the generally unfavorable weather in the spring, there has been practically no fishery for quinnat on the outside grounds at that season, but in the fall this species may be taken there to a small extent.

The length of the drift nets in British Columbian waters is limited by law to 150 fathoms, and the most of those in use are probably of about that size. There is no restriction upon their depth, but custom fixes it at 50 to 55 meshes, though some are narrower. Two sizes of mesh are recognized by law. The larger, intended for the quinnat salmon, measured 7¾ inches in extension, until 1897, when it was reduced to 7 inches, and may be used from March 1 to September 15. The smaller, designed for the sockeye, silver salmon, etc., measures 5⅞ inches, and may legally be employed from July 1 to August 25, and again from September 25 to October 31. Between September 15 and 25, and between November 1 and March 1, all salmon fishing with nets is prohibited. The quinnat nets are employed mainly in the spring and early summer, but also to some extent in September, when the quinnat run is smaller and the fish are not in so good condition. The smaller mesh is used mostly during July and August, when the sockeye are present and the canneries are in active operation. The close season, beginning August 25, is to permit the last of the sockeye schools, in which the fish are well matured, to reach their spawning-grounds unmolested. The fall season of the small-meshed nets allows for the capture of the silver salmon, but the fishery at that time is not extensive, as the demand for this species is very much less than for the sockeye.

The twine of which the nets are made is of the best flax, but being loosely laid has a very coarse appearance compared with that used for gill nets in the Great Lakes and elsewhere in the East. The nets constructed of it, however, are said to be better adapted to the large catches of heavy fish so generally obtained on the Fraser River, although the fine hard twine is best for clear water. The cost of the nets fully rigged is about $100 apiece. They are lightly tanned and sometimes a little tar is used upon them. With care they can be made to last three or four years, but with the ordinary hired fishermen their life is generally measured by a single season. They are fitted with lead sinkers and wooden floats. The buoys are sometimes of wood, but square tin oil cans are very commonly employed for this purpose.

The boats are mostly small skiffs, about 20 feet long, generally manned by two, occasionally by three, persons. In recent years the

Columbia River boat has been introduced and is now used to a considerable extent in the lower part of the river and outside. Its breadth and centerboard make it much safer for the more exposed places.

All gill nets in British Columbian waters are, in accordance with law, used adrift. This method appears to be best suited to most of the requirements of the region and has given entire satisfaction. The current in the Fraser River is generally too strong for set nets, and with the large number of nets there employed only the one method of fishing them would be advisable. All nets are drifted at the surface, each being handled by a single boat, to which it is attached at one end, the other end being indicated by its buoy.

Up to 1891, inclusive, the number of drift nets in use was limited to 500. Since then, however, licenses have been issued to all bona-fide fishermen, British citizens and residents, who make application. The canneries and other establishments dealing in salmon are allowed several nets apiece, but each independent fisherman is entitled to only a single net. The number of licenses issued and the total length of the nets employed each year since 1891 have been as follows:

Year.	Number of nets.	Total length of nets in yards.	Year.	Number of nets.	Total length of nets in yards.
1892	721	252, 580	1895	1, 733	528, 000
1893	1, 072	355, 900	1896	....	803, 801
1894	1, 666	503, 900	1897	....	709, 400

To insure their identification the boats of the independent fishermen must be marked with their license number, but canneries and dealers have each their separate series of numbers, as each receives only a single license for all its boats.

A varied nationality is represented among the drift-net fishermen, including Indians and negroes, there being a very large number of the former. The arrangements with them differ. Some own their boats and nets and dispose of their catch by contract; others are supplied with their outfit by the canneries and fish on shares, while others again, the Indians especially, are employed on day wages. The independent fisherman in possession of an outfit is supposed to fish it himself, and his hours are measured by his endurance. The canneries, however, generally hire two gangs for each of their boats, in order that they may be kept at work both day and night. The licenses do not define the position which each fisherman may occupy with his drift net. The law provides, however, that the nets shall be kept at least 250 yards apart and shall not be used so as to obstruct more than one-third the width of the river, but it has been manifestly impossible to comply with these regulations—the first, especially—since the number of nets has increased so greatly; and the second, because in many places the width of the river is less than three times the length of the nets.

The fishermen are left to arrange these matters among themselves, and whether they do so by tacit understanding or not, there is little or no interference among them. Each selects, so far as he can, what seems to him the best location, and may change it from time to time. As the nets are floating no fisherman has a clear piece of ground to himself, but they follow one another in groups over the same ground, and move upstream again after completing their drift or after having made a certain distance. The drifts may vary from 1 to 2 or 3 miles, and are sometimes shorter, dependent upon the abundance of fish and other circumstances. The best conditions for drifting are said to occur at slack high water, whether at night or in the daytime, and most fishing is done at that stage of the tide. The nets then hang more vertically and it is the general opinion that there is also then a better movement of the fish. When the river is high and swift they attempt to fish more along the sides and in the eddies, as the fish seem to seek the places of least resistance, but when it falls they do better in the channels.

The nets are customarily set at right angles to the current, but as the velocity of the latter varies at different points across the channel and eddies frequently occur, the nets do not long remain spread out in the direction intended, but take irregular courses with a general tendency to trend up and down stream. In some places, where bars so exist as to cause the fish to move crosswise of the river, the nets may do best in the latter position, but, as a rule, they are not allowed to head off much before lifting begins. On the outside grounds it is also the practice to set across the current, and some of the most successful drifting is there done by starting a net near the mouth of one of the river channels and allowing it to be carried as far as the current serves, which may be a long way when the river is in flood.

An opportunity for studying the effect upon the salmon runs of the extensive drift-net fishing now carried on in the Fraser River is afforded by the weekly close times, but practically no attention has been given to the subject. All fishing being prohibited from 6 o'clock Saturday morning until the same hour Sunday evening, the salmon are given an unobstructed passageway up the river during thirty-six hours out of every seven days. The movement of the fish is not, of course, uniform or even continuous throughout the season or any extended part of it. While, therefore, it is impossible, without the necessary observations, to pass definitely upon the matter, yet at the end of each weekly close time it is expected that a proportionally much greater quantity of fish may be found in the neighborhood of New Westminster than at other periods of the week. On Sunday evening, as the time for fishing reopens, the work begins actively about New Westminster, the river being covered by as many boats as can safely operate, and the catch per net being as good as at least the average on the lower drifting-grounds. Such success does not continue long, and during the remainder of the week comparatively few boats remain on the upper grounds.

In the interest of the protection of the fish it would be important to ascertain what proportion of the run is removed by the large amount of netting used on the Fraser River during the past few years. Such information as we possess is very indefinite at the best, but the evidence presented by the circumstances attending the weekly close time argues strongly in favor of the continuance of that protective measure. In illustration of this matter may be cited the catch by the drift-netters during the night of Sunday, August 16, 1895, which was said to have exceeded 700,000 sockeye, the largest single night's catch on record up to that time at least.

WASHINGTON.

Gill nets are employed in both the salt waters and rivers of Washington, but much less extensively than in British Columbia. Their use extends quite largely to the clear open waters, where they are only serviceable at night, and they are fished both set and drifting. The fishery is for the most part somewhat irregular, and aside from a few localities is prosecuted in a small way at scattered places, much of the catch being disposed of locally, although a good part of the fresh supply, especially of quinnat, sent to the larger markets, such as Seattle, is the product of this class of nets.

Skagit Bay and River seem to have been the seat of the most important operations of this character. About 50 nets were employed on the latter in 1894, 35 belonging to white men and 15 to Indians. The set nets measured 15 fathoms long and 15 feet deep, some having a 5¾ and others a 9 inch mesh; they are anchored in little indentations of the river bank to avoid the swift current as much as possible. The drift nets were 50 fathoms long and 15 feet deep, with a 9-inch mesh, being used mostly for the quinnat. The nets were larger on the bay, some measuring 125 fathoms long and 18 feet deep, a 9-inch mesh being used for the quinnat and a 5¾ or 6 inch mesh for the sockeye and silver salmon. Since 1895 there has been a large increase in this fishery, which has mainly been brought about by the establishment of new canneries, especially at Anacortes. The gill-netters, however, have had difficulty in competing with the trap nets, which afford the cheapest means of taking salmon here, as at Point Roberts, and in 1897 a strong but futile effort was made to secure the passage of a bill prohibiting the latter class of apparatus.

Boundary Bay is another relatively important place for gill-netting, and in other places about the shores, as well as in many of the rivers, this method is also followed, the extent of fishing varying in accordance with the opportunities and the demands. In some places only two or three small nets may be employed to supply the local wants, while in others the advantages for shipping or canning interests may stimulate a considerable activity. Even in such small rivers as the Elwha and Dungeness, on the south side of the Strait of Juan de Fuca, having only 2 or 3 miles of level course, several nets may be in use, and such fish as are not required at home find their way to the Seattle market.

PURSE SEINES.

The purse seine is, next after the trap net, the most important appliance used for the capture of salmon in the United States waters, where it is said to have been introduced about 1886. It resembles the purse seine of the Atlantic coast, but differs from it in some particulars. Its construction and mode of use have been described in the Bulletin of the United States Fish Commission for 1888 (pp. 55, 56), and in the annual report of that Commission for the same year (pp. 254–256). The nets are very large and therefore of great capacity, the catch often amounting to several thousand salmon at a single haul. In those whose measurements have been brought to our attention the length varies from 150 to 250 fathoms and the depth from 14 to 25 fathoms in the bunt. The mesh is from 2½ to 3 inches. Two boats are required for operating a purse seine—one for setting the net, the other, a scow, for pursing it, the latter also having accommodations for the catch.

Purse seines seem not to be well adapted for taking the sockeye, which are apparently too alert and active to be readily captured by this means, although small quantities may sometimes be so obtained. They appear to be employed mainly for the silver salmon, but also to some extent for humpbacks and dog salmon. It is the only kind of apparatus, aside from hooks and lines, that can be utilized in the open waters at a distance from the shores, and as the salmon of certain species may school anywhere it is destined to remain one of the most important fishing methods, especially for supplying the large catches demanded by the canneries.

The most important fishery with these nets, having its principal headquarters at Seattle, has been carried on throughout the upper part of Puget Sound from the vicinity of Everett to Commencement Bay, and to some extent in Hood's Canal. In 1895 Seattle had at least 11 purse seines in use, and in 1896 probably not less than 20. Keeping track of the schooling fish, many of the nets are often concentrated in a single place, covering the water over a considerable area and making large catches. Although chiefly operated in the interest of canneries, the fresh and salt markets also obtain abundant supplies from this source. Single seine hauls in the upper part of the sound frequently exceed 1,500, and may reach over 2,500 silver salmon. The catch of the gang of nets belonging to the Seattle cannery is said to have averaged 12,000 salmon daily during the height of the season of 1895.

In other parts of the region purse seines have not been as systematically employed. Some have been used about the San Juan Islands, and in 1895 they were first tried in the Strait of Juan de Fuca, with the object of obtaining supplies for the cannery established that year at Port Angeles. The fishing-ground was mainly in the vicinity of that place, but sets were also made near Race Rocks and elsewhere in the eastern part of the strait. About Point Roberts a few purse seines seem to have been operated nearly every year since their introduction, but not with any regularity, and as a whole these nets may be said to have cut a small figure in connection with the fisheries of that region. This has been especially so since the rapid increase in the number and efficiency of the traps began. In 1893 and 1894, when three or four were in use, they did very well, and in the latter year a good proportion of the cannery supplies at Point Roberts were so obtained. In 1895, however, the catch by this means was reported very small, as the traps furnished sufficient quantities of sockeye from day to day to supply the canneries and no silver salmon were canned.

The total number of purse seines reported for the Puget Sound region in 1897 was 46, and in 1898 it was 40.

DRAG SEINES.

Although drag seines were sometimes employed on a small scale in connection with the early fishery of the Fraser River district, they have been entirely prohibited for a considerable period throughout British Columbia, except in certain localities outside the region under discussion, where the water is too clear for gill-netting. In Washington they seem to have been the earliest form of net introduced by the whites, and they are still widely used, though not very extensively in any one place. Their first employment to any extent was apparently at Point Roberts, where the traps have virtually superseded them. They were there hauled mainly around the southwest corner of the point, and thence up along the west side to a distance of 1½ miles, the shore elsewhere being generally unsuited for the purpose. When rounding the southwest corner a part of the salmon keep well in to the shore, yet large catches of sockeye were never made there, and if 300 or 400 fish were captured at a haul it was considered a fair result. In the early fall, however, the silver salmon would be taken in greater numbers. As the traps multiplied and were made effective the seines gradually went out of use, though they may still be employed occasionally.

The most important recent drag-seine fishery seems to be that which has now been carried on for a number of years to obtain salmon for canning purposes at Seattle. Eight nets, measuring from 200 to 600 feet long and with a 3-inch mesh, were in use in that connection in 1895. Near the mouth of the Skagit River 6 seines were operated in 1894, 2 by the whites and 4 by the Indians. The former were about 600 feet long by 30 feet deep; the latter 180 feet long by 10 feet deep, both having a 3-inch mesh. Seining is also done in the neighborhood of Utsalady, in Skagit Bay, and in both of these localities relatively large catches are said to be made. Good seining grounds are reported in the vicinity of the mouth of the Nooksack River, though they had not been much resorted to up to 1895.

Small seines are employed to some extent for salmon, by both whites and Indians, at several places along the south shore of the Strait of Juan de Fuca, chiefly in Discovery Bay and about Dungeness and Point Angeles. Nearly all the catch is consumed locally, but small quantities may be carried to market as far east as Port Townsend. The species principally obtained are humpbacks and silver salmon. The cannery established at Port Angeles in 1895 had 12 seines in use in that vicinity the same year.

Small seines will undoubtedly be found elsewhere in nearly all places along the Washington shore where settlements exist, and where the conditions are suitable for taking salmon by this method. This form of net is one of the most convenient to operate and affords a ready means for securing food.

The total number of seines employed in the Puget Sound region in both 1897 and 1898 was placed at 59.

REEF NETS.

The reef net is the exclusive property of the Indians, by whom it has long been used. Its name is derived from the character of sea bottom for which it is specially adapted—the peculiar kelp-covered reefs—but while such abound throughout the region, the number over which the sockeye pass in sufficient quantity to furnish good fishing seems to be comparatively small. Formerly the nets were made from the fiber of cedar bark or roots, the preparation of which was a winter occupation and consumed much time. Cotton twine is now used and since its introduction the nets have been enlarged. They consist of a piece of webbing, which varies more or less in size, but may average perhaps from 36 to 40 feet long by 25 to 30 feet across, the mesh being about 3½ inches.

To prepare for fishing a channel of suitable width is cut through the kelp, and in this the net is set between two canoes so anchored from both ends as to keep them parallel with and at the sides of the passageway. The suspension of the net is accomplished by means of guy lines leading from the canoes and head anchors. In the position which it then assumes the front end, facing the current, sinks near the bottom, while the hind end curves to near the surface. Although the kelp may be quite submerged along the sides of the channel, still it tends to direct the fish toward the net, and their movements may still further be controlled by short leads of kelp run out from the front corners of the latter. In case the depth of water is too great, ropes are sometimes stretched across the channel below the front margin of the net, and to these bunches of reeds may be attached with the object of turning the fish upward.

The salmon, approaching with the current, pass upon the net. They do not mesh, nor is there anything to prevent their escaping at the sides. It is at this point that the Indians are required to display their skill. An experienced man stands in the bow of each canoe as a lookout, while each of the guy lines is in the hands of a member of the crew. The moment fish are seen coming over the net word is given to haul in, a command which must be promptly obeyed. The side lines leading to the stern anchors are tripped at the same time, causing the boats to come together, so that the net can be gathered up from all sides in a sort of bag. The contents are emptied into the canoes, the net is again thrown over and spread out, and the watching resumed. Success depends upon the net being hauled quickly and properly at the right moment. Should the fish have turned before the first step is taken, they are likely to escape wholly or in greater part. Constant vigilance is required, but the Indians have become so expert that they seldom fail to land their catch, and their success seems to depend only on the appearance of the fish in sufficient quantity.

When the fish are running well a large reef-net crew will consist of 10 to 15 Indians, as at Point Roberts, but in some places the nets are smaller and the crew may not contain more than 6 to 8 men. On Cannery Point Reef it is said that under exceptionally favorable conditions a haul can be made every 2 or 3 minutes, and a single large catch may fill the two canoes. With fishing at its best a single net may secure as many as 2,000 salmon in a day, but to do this the fishing canoes must continue at their posts, the catch being transferred to shore by other boats. In 1894 and 1895, however, scarcely anything was accomplished with the reef nets in this locality.

The proper time for fishing with these nets is during the set of both the ebb and flood tide, when the current is running not swifter than 5 knots an hour. They can only be used in clear water, as it is essential that the salmon should be plainly seen; when the water is muddy or the surface rough nothing can be done. While originally the Indians employed this method only for a short period each season to supply their own wants, in recent years they have found a ready sale for their entire catch, which, consisting as it does mainly of sockeye, is in great demand at the canneries. The money value of this species is now so great that they retain only small quantities at the most for drying. Reef-net fishing could not, however, be profitably followed by the whites, owing to the number of hands required to operate the net and the great loss of time resulting from unfavorable conditions of sea and weather. The Indian reef-netters belong partly to the Lummi Reservation and partly to British Columbia. The latter fish chiefly about the San Juan Islands, coming over specially for that purpose.

What is probably the largest and has been the most productive ground in the region for this kind of fishing is the reef directly south of Cannery Point, at Point Roberts, which has been described in another connection. From 15 to 20 nets were formerly fished here at a time, and with much success; 16 were in operation in 1889, but in 1894 the access of salmon to the reef had been so cut off by strings of trap nets as practically to destroy its advantages, although the Indians still visit it. Each crew had formerly two places to fish upon, one for high and one for low water, in order to extend the hours of work, it being considered preferable that the water should not exceed 8 feet in depth at the time of fishing.

Between Village Point and Bluff Point, on the outer side of Lummi Island, there is also an excellent ground, with capacity for about 6 or 7 reef nets, which is resorted to by the Indians from the neighboring reservation. Salmon have been abundant here and large catches have been made, but, as at Cannery Point, trap nets have recently been so placed as to divert a large proportion of the fish from the reef and reduce its value for the purposes of the Indians.

There is a small but productive reef inside of Iceberg Point, at the southern end of Lopez Island, on which a few nets are used, and where daily catches of 3,000 to 4,000 salmon are sometimes made. Both sockeye and silver salmon are taken at this place, the former at least being now mostly sold to the cannery at Friday Harbor, and in good seasons the reef is an important source of supply. The nets are sometimes set in an extreme depth of 18 fathoms. We were told by some of the Indians fishing here that although they have tried for quinnat they have never been successful with that species, probably because it does not appear in defined schools. Humpbacks and dog salmon occur abundantly, but are not fished for, as they have no sale. There seem to be no other reef-net grounds about Lopez Island, but several small ones are fished off the west side of San Juan Island and off both the east and west sides of Stuart Island. Others probably exist, of which we obtained no definite information.

HOOK-AND-LINE FISHING.

The quinnat and silver salmon are the only species which will take bait and can be fished for with a hook. The fishery by this means, trolling with bait or spoon, is insignificant compared with the net fishery, but it affords the opportunity for securing especially the quinnat in the winter and spring when nets can not be used profitably if at all. The catch so made is disposed of to the fresh markets or utilized for domestic purposes by the fishermen. Both Indians and whites engage in it, the former most extensively. Some of the more prominent localities for this fishery are off Victoria and Port Townsend, about the San Juan Islands, off Nanaimo, and off Point Roberts, and in some places it is indulged in for sport as well as for securing food.

Sport fishing for salmon with fly and spoon is carried on to a limited extent in some of the smaller clear rivers, especially in British Columbia. The quinnat is said to be the only species which can be so taken, and the fishing-places are the pools in which they rest during their journey upstream. Trout are also very abundant in such localities and are obtained by the same means. The Indians about Neah Bay do a great deal of trolling for salmon to supply their own wants, the fishes of this group following next after the halibut in importance as an article of food among them. The fishing season there is chiefly the months of June, July, and August. Details regarding the hook-and-line fishery have already been given under the headings of the quinnat and silver salmon.

SPEARS.

Spears seem to be used rather extensively, in the clear, shallow upper waters of many of the rivers, for obtaining salmon as they approach their spawning-grounds. The fish so taken are, naturally, not in the best condition for food, nor are they sought by this means for commercial purposes, unless it be to supply a local demand. The Indians follow this method most, but white settlers also employ it where they have the opportunity to do so, and often in this way add greatly to their stock of food. In some localities the catch must be relatively rather large, as is known to be the case in the upper waters of the Skagit River. Besides the ordinary form of spear, a gaff is also frequently employed, the handle to either one being sometimes made of extra length to permit of its being used from the banks of a stream. Under favorable circumstances it is said to be possible to select from the fish, as they pass by, the particular species that is most desired or the more robust and healthy individuals.

DISPOSITION OF THE SALMON CATCH.

Until quite recently this region has occupied, from the standpoint of trade, a position of comparative isolation which the completion of railroads has only partly overcome, owing to its distance from large consuming centers. In the development of the salmon fishery and the disposition of the catch it has, therefore, been necessary to resort to methods of preparation which would insure the preservation of the product for indefinite periods. Salting naturally came first, followed by canning, while now the shipping of fresh salmon is a rapidly growing business.

The salting process was introduced at the beginning of the century by the Northwest Company and afterwards continued by the Hudson Bay Company, primarily for the purpose of providing a winter stock for the use of their employees and for local sale. As the facilities for shipping opened up, an export trade began, which finally reached large proportions and has long constituted an important feature of the salmon industry on both sides of the boundary line. Requiring little outfit, this branch has been engaged in by men of small means as well as by establishments having considerable capital. While both the quinnat and sockeye are utilized in this way, the greater part of the output consists of the cheaper grades of salmon. The product is mostly disposed of to the eastern United States and to Australia, the Hawaiian Islands, China, and Japan.

The smoking of salmon was also begun in British Columbia at an early date and was subsequently taken up in Washington, but the quantity prepared in this way has always been small.

Canning presented a somewhat more refined method of preparation, the product of which soon gained great and world-wide popularity. The growth of this particular branch of the fishery was quite rapid from the beginning, and during the past few years has been remarkable. Its limitations are measurable only by the supply of fish and the restrictions of trade.

The utilization of the salmon from this region in a fresh condition, except locally, was long delayed, owing to the lack of transportation facilities to large markets, of which there are none in proximity to the Pacific coast. The preference for fresh fish, however, led to the early utilization of through railroad communication to place the western species in competition with their Atlantic congener in the very home of the latter. This trade is now having a marvelous development. It reaches the larger cities along the Atlantic seaboard and in the interior of the country, and has recently found an outlet in Europe and other parts of the world. Shipments have chiefly been made during winter and spring when the salmon are in best condition and the weather is most propitious. Ice is used in packing to the extent made necessary by temperature and other conditions, and freezing methods have recently been introduced.

The quinnat is preferred for the fresh trade, and in the spring, before the Atlantic salmon are in season, it commands so high a price as to make its purchase for canning purposes unwarranted. The steelhead is also a fresh-market fish and is sold almost exclusively as such, it being obtained most abundantly in the best condition during the winter, when the fewest difficulties attend its shipment. The sockeye and other species are likewise utilized in this trade, but the latter least extensively on account of their lighter color.

The most important centers for the shipping of fresh salmon are New Westminster, in British Columbia, and Seattle, in Washington, but small quantities may be sent inland directly from a few other places, more especially from Tacoma. The bulk of the fish intended for this trade, however, is forwarded to one or the other of these cities from fishing-grounds or from collecting places on steamer routes. Thus Seattle may derive its supplies of quinnat from the Strait of Juan de Fuca by way of Port Townsend, from the San Juan Islands through the several stopping-places which the steamers have in that group, from Skagit Bay and River, and so on, the entire field tributary to Seattle being an extensive one. The New Westminster supplies come partly from the Gulf of Georgia, but mainly from the Fraser River.

The freezing of salmon seems to have been started on the Fraser River as early as 1886, but not much was apparently done in that line until within a few years. There are now several freezing establishments in British Columbia and Washington, and the business outlook is exceedingly promising. By this method not only may a large stock of fish be laid in when the season serves best, to be disposed of as demands arise, but a way is opened to new and more distant markets. The prospects are for a large and profitable trade which shall greatly increase the fishing industry of the region.

The local trade in salmon is relatively large in comparison with the extent of population, the low price at which they can generally be obtained, especially the least desirable commercial forms, placing them within the reach of all. Many of the inhabitants fish for their own table, using nets and spears in the rivers and the trolling hook in salt water. The Indians have always depended very largely on the salmon, one of their chief occupations having been the preparation of a large winter stock by drying. In some places, where they have come much in contact with the whites and are receiving pay for their labor or catch, this custom is not so strictly followed, if at all, but the total Indian consumption in British Columbia is estimated in the official statistics at a very high figure.

CANNERIES.

In that part of British Columbia here under consideration the canning industry seems always to have been confined to the Fraser River, for the reasons undoubtedly that it is the only place where the sockeye can be taken abundantly and where the other species of salmon may also be captured more readily than elsewhere. The first cannery on the Fraser was apparently built at Brownsville, opposite New Westminster, about 1870 or 1871. It was removed to New Westminster in 1873 and one or more small ones in addition are said to have been in operation the same year, when the total output of canned goods was reported at about 390,000 pounds. The regular series of statistics for the British Columbian coast date from 1876, when there were 3 canneries with a total pack of 511,056 pounds. In 1883 the number had increased to 12, but it fell off the following year to 6, and was the same in 1885. Since then, however, there has been a steady and rapid increase, their number amounting to 31 in 1895 and to 45 in 1898.

Changes have taken place in the location of the canneries, which are interesting to note. The industry was formerly carried on more extensively in the upper part of the drift-net region, there having been at one time as many as 4 canneries in the neighborhood of New Westminster, where now there is only 1. The center of the canning business has worked down the river, as the fishing has been carried more and more in that direction. Ladner and Canoe Pass became the centers for a time, but it has now been transferred to Steveston, at the main entrance to the river, where in 1895 about one-half the total number of canneries was located. This place is now most centrally situated with regard to the more productive fisheries, having on one side those of the outer grounds and on the other those in the lower part of the river. In 1895 there were only 6 canneries above the village of Ladner, 15 at Steveston, the remainder being on the south bank from Ladner to Canoe Pass. The number of canneries on the Fraser River, together with the pack in each year since the beginning of the industry, is given in the statistical table for British Columbia.

Outside of the Fraser River the principal cannery sites in British Columbia are on the Skeena River, where the business was started as early as 1875, and on the Naas River. There has been a small cannery at Alert Bay since 1880, drawing its supplies of sockeye from the Nimkish River, which empties on the adjacent coast of Vancouver Island, and 2 are located on Clayoquot Sound, western coast of Vancouver Island, one established in 1895, the other in 1896. Except during three years when the sockeye runs were very small, the Fraser River pack has exceeded, and generally very greatly, the combined pack of all the other canneries of the Province.

The greater part of the canned salmon produced in British Columbia has always been exported to England, being shipped by vessel, generally in large lots. The remainder is divided between Australia, other foreign markets, and the Canadian trade.

The canning industry is of more recent date in the Puget Sound region of Washington than in British Columbia, and is still less extensive, although during the past few years its growth has been very rapid. Not having the same river facilities as British Columbia, it is necessary to look more to the salt waters for its supplies, and in the matter of obtaining sockeye, the species most cherished for canning purposes, its advantages are considered not so good. It would thus appear as though Washington could never expect to produce as large a pack of the higher-priced fish as the Fraser River is capable of supplying, though it may prove otherwise, but of the inferior species Washington has sufficient abundance to permit as great an expansion of the business as the demands of trade are likely to warrant for some years to come.

In 1895 there were only 6 canneries in operation on the Washington side of the line. The oldest establishment was started at Muckilteo in 1877, removed to Port Blakely about 1880, and subsequently to Seattle, where it is now located. The species put up are silver, humpback, and dog salmon, together with a few quinnat when they can be obtained. In 1880, 15 hands were employed and the pack amounted to 10,000 cases, while in 1895 the pack reached 81,177 cases. At one time there were 4 canneries in the neighborhood of Seattle, but 3 of these are no longer in operation, although a new one was established there in 1897. The next oldest cannery still in existence is the one established in 1891 at Semiahmoo, at the eastern end of Boundary Bay, which, beginning with 1894, has been run in conjunction with the one built at Point Roberts in 1893. Both draw their supplies from the trap nets about that point, the most of which they control, and also, to some extent, at times from other nets in Boundary Bay. These 2 canneries, therefore, under present conditions are the most advantageously placed of all the canneries south of the boundary with regard to obtaining supplies of sockeye, and their attention is almost entirely confined to this species except in seasons when the run proves short. Some silver salmon, humpback, dog salmon, and quinnat have been put up at both of them.

A good-sized cannery was founded in 1894 at Friday Harbor, on the eastern side of San Juan Island, which is a convenient center for securing sockeye from the various fisheries about the San Juan group. Its supplies up to 1896 had been obtained chiefly by means of traps at the southern end of San Juan Island and from the Indian reef-netters, but apparently it has been found impossible to rely entirely upon the catch of that species. In 1895 a cannery was built at Port Angeles, with the expectation that a sufficient quantity of sockeye for its own use could be obtained in the Strait of Fuca, but all efforts to that end have met with failure, and it has been obliged to look elsewhere for its stock of that species. Some years ago a similar experiment was tried at Clallam, but it was soon abandoned. The sixth cannery examined in 1895 was an experimental one of small size in Bellingham Bay, which expected to obtain its catch in the vicinity of the mouth of the Nooksack River.

There were 11 canneries in operation in 1896; 12 in 1897, and 18 in 1898. The new ones were located mainly at Blaine, on Lummi Island, in Bellingham Bay, at Anacortes in Skagit Bay, and at Seattle. At Anacortes there were 3 canneries, all established in 1896, with the object of taking advantage of the run of sockeye belonging to the Skagit River. The pack in 1897 was exceedingly large, and to a very great extent consisted of sockeye, of which the run in that year, as elsewhere explained, seems to have been unprecedented.

On the Fraser River the canning season is practically coincident with the period of the sockeye run. A few canneries may start up in June in order to do something with the quinnat, and in those years when the supply of sockeye is inadequate for a full pack some establishments may continue operations during more or less of the silver salmon run. In Washington also little or nothing is done before the appearance of the sockeye, and while most of the canneries there would be satisfied to close with that species, could they obtain it in sufficient quantity, nearly all have been more dependent on other species than the Canadian canneries and are more likely to keep open later. The Seattle canneries, whose supplies are obtained outside the sockeye region, begin operations much later than the more northern canneries and continue them during the greater part of the fall.

While the positions of trust in the several canneries are chiefly filled by whites, nearly all the labor, both in British Columbia and in Washington, is performed by Chinese, who become exceedingly expert in every branch of the business and work rapidly. The secret of their employment to so great an extent is the cheap rates of compensation with which they are satisfied—a condition which practically excludes white labor, but without which it is difficult to see how the canning industry could now be maintained. It would, moreover, be impossible, under existing circumstances, to secure the amount of white labor required in the large canning districts, in view of the temporary nature of the work. In some of the canneries, especially on the Fraser River, Indian women and children are employed to clean the fish after they have been eviscerated, being members, generally, of the families of the fishermen who are operating in the same neighborhood.

It is important to note in this connection the amount of waste which occurs in the preparation of salmon for canning. In cutting off the heads, tails, and fins sufficient care is not always exercised, and much flesh suitable for canning too often goes with the refuse. This improvidence is largely owing to the abundance of fish, and it is scarcely to be expected that a remedy for it can be found while the supplies continue so prolific. The total loss in weight to the fish during this process, including the removal of the entrails, ranges from 25 to 50 per cent, and is probably seldom less than 30 to 40 per cent. The greater part of the waste is of course unavoidable, and the most that can be hoped for in this regard is that some use will soon be found for it.

FISHERMEN'S PRICES.

The prices which the fishermen receive for their catch depend upon the species and fluctuate in accordance with the supply and demand. They vary markedly in different parts of the same season as well as in different years. The matter is mostly regulated by the canneries during the period when they are in operation. When the quinnat first begin running on the Fraser River in the spring and are in greatest demand for the Eastern trade they may bring as much as from $1 to $1.25 apiece, but the price soon falls, reaching 75 cents and even less. The highest price which the British Columbian drift-netters obtain for sockeye is about 25 cents each, but this figure prevails only at the beginning of a season or during one in which the catch is small and causes a sharp competition among buyers. As the season advances and the fish become more abundant it may fall off to any figure as low as 15 and even 10 cents, while during summers when extraordinary runs occur 6 or 7 cents may be as much as a fisherman can expect to receive, and even then not all of his fish may be wanted. In 1897 many were glad to get as high as 3 cents, and a large part of the catch was refused at any price. The customary range in price, however, is from 15 to 25 cents.

At Point Roberts it is said that, except when sockeye are scarce, the cost of their capture by trap nets is much lower than the prices paid on the Fraser River, and it is probably the same elsewhere when fish are abundant. In this way the Washington canneries which obtain their supplies from this source are considered to have a marked advantage over the Canadian. The sockeye taken in the reef nets at Point Roberts, Lummi Island, and the southern end of the San Juan Islands were bringing 10 and 15 cents apiece in 1894 and 1895, but the Indians are often paid no more than 5 to 8 cents for them.

From 5 to 8 cents is a common price for silver salmon, while dog salmon range from 2 to 6 cents apiece. During the winter the steelhead bring about 3 to 4 cents a pound for the fresh markets.

POLLUTIONS AND REFUSE.

There seem at present to be no sources of pollution in this region which can be considered as positively detrimental to the fisheries in the salt water, and the same also appears to be mainly true as regards the rivers, except as to some localities of limited extent. This may be accounted for in greater part by the scarcity of large settlements and the generally low temperature of the water.

Sawmills have been built on many of the rivers, on some of them quite extensively, and the large amount of refuse which they produce may, unless suitably cared for, be the cause of great and irreparable injury, as has been so strikingly illustrated on the rivers along the Atlantic coast. On the Fraser River the number of mills is not great, and the laws regarding the proper disposition of the sawdust are said to be quite generally observed. In Washington, while the throwing of sawdust into the streams is prohibited, it is reported that the regulations had not been well enforced, although some change may recently have taken place in that respect. Attention has been especially called to the Skagit River, on whose banks there are numerous shingle mills, from which a very large amount of refuse is allowed to enter the water. According to the statements from the fishermen in that region, this practice has caused a great deal of damage to the spawning-grounds of the salmon and has affected the fishery in other ways.

The proper disposition of the offal produced in connection with canning operations presents a problem of very great importance for this region, especially as regards the Fraser River, where the industry is most extensive. The refuse from this source, consisting of the heads, fins, tails, and entrails, has as yet no market value and must be quickly disposed of. Its quantity is very great, equaling at the lowest calculation more than one-fourth the total weight of the fish utilized, and at this rate amounting to from 650 to 3,800 tons annually on the Fraser River alone. In many cases it runs up to 40 and even 50 per cent. When it is further considered that the season lasts only from four to six weeks, and that the bulk of the fish comes in spurts, lasting only a few days each, the difficulties of the situation can be fully realized. The generally prevalent custom is to allow the refuse in its fresh condition to drop into the water underneath or alongside of the cannery. As the water of this region, both at sea and in the rivers, has a relatively low temperature at all times, this practice is less open to objection than would be the case in a warmer climate.

The Washington canneries are all located on the salt water in more or less exposed positions, where the tide generally runs strongly and the depth increases rapidly. The greater part of the refuse disappears at once and is never heard of, although in some places a certain proportion may be washed upon the shores. There is no reason to believe that it has anywhere been detrimental to the fishing interests, and in view of the sparsely settled condition of the coast in the vicinity of nearly all the canneries there seems to be little occasion for concern from a sanitary standpoint. The number of canneries must also for some time remain too few to make the disposition of their refuse a question to be handled by other than the local authorities.

On the Fraser River the matter is more serious, as nearly all the canneries are located within a distance of 6 to 8 miles of the mouth of the river; yet even here there is no evidence that the offal has had any deleterious effect upon the run of salmon. That injury of that character is scarcely to be expected from this cause is indicated, moreover, by the still worse conditions produced each season about and immediately below the spawning-grounds by the floating masses of dead and decaying fishes through which the fresh arrivals continue their ascent, in no way checked by the foulness of the water. The pollution in those places is strikingly in evidence, while in the region of the canneries there is generally little to be seen. The large volume of water in the lower part of the river, combined with the strong current and low temperature, tends to dissipate the offal, which mainly disappears as completely as in the sea. It is a common local belief that much of it is consumed by the small fishes which are reported to swarm about the cannery sites, but it is doubtful if they exert any appreciable influence in disposing of this immense amount of refuse. Sometimes, it is said, the offal is stirred up by the eddies so as to become caught in the drift nets when they are fished in shallow water, but such occurrences are evidently quite infrequent.

From a sanitary point of view, however, the offal has proved a nuisance in some localities. This is not so at New Westminster, where no trouble from this source has been reported. The uppermost point at which complaint was made is Ladner, and the conditions are also often bad in the neighborhood of Steveston. In this region the offal is sometimes stranded by the current or retained by the eddies, so that when the tide is out it may become exposed on the bars and in places along the banks, emitting an exceedingly offensive odor. It is also drifted into some of the sloughs, and may thus be carried some distance inland, greatly to the annoyance of the farmers, who have often to depend upon the water from these places for domestic use. The local authorities at Ladner have been making strenuous efforts to abate the nuisance on the score of injury to the public health, but at last accounts they had not been entirely successful.

Several expedients have been tried to obviate the trouble caused by the cannery refuse, but all have ended without definite result. The Canadian law forbids throwing it into the river, but as the enforcement of the regulation under existing circumstances seems to work injustice to the canneries, its operation has generally been suspended, with the expectation that some advantageous method of disposing of the offal would sooner or later be discovered. It was at one time insisted that unless disposed of for fertilizing purposes it be buried on shore, be carried out and dumped in the Gulf of Georgia, or be confined in cribs underneath the canneries; but none of these provisions continued long in force. When held in cribs a nuisance was created by the oily matter running from the mass of decaying fish, and the inclosures would often break open, allowing a part of their contents to escape. If retained in cribs or in scows, even for a short time, the refuse was rendered largely buoyant by the formation of gases in the putrid flesh, so that when deposited in the gulf much of it remained floating at the surface, and with a flood tide and westerly wind would be drifted on the shore or even into the river mouth. The outside dumping-ground has now become one of the most important of the drift-net areas, and the inexpediency of continuing its use for the former purpose is fully recognized. Could the refuse have been carried farther out into the middle of the gulf this trouble would have been mostly prevented, but at a greatly increased cost.

Several attempts have been made to utilize the offal by converting it into fertilizer on a commercial basis, but as yet unsuccessfully. Its very oily nature makes the process difficult and expensive, and another serious trouble arises from the immense quantity required to be handled during the brief period of the fishery, necessitating extensive arrangements, the cost of which would scarcely be warranted by the shortness of the season.

While the offal is fresh it sinks at once and gives no trouble, except under the circumstances previously described. Until some positively better plan has been discovered, this seems, therefore, to be unquestionably the preferable way of disposing of it, provided certain precautions are observed. It should be allowed to go into the river only where the water is sufficiently deep and the current strong enough to cause its dissipation. If these conditions do not exist at certain of the cannery sites, then the offal there produced should be carried elsewhere for deposition. A study of the conditions is called for in all localities where canneries are in operation, and the gravity of the question presented by this subject warrants extreme measures to preserve the cleanliness of the river for the sake of the general health and appearances. As regards the salmon, however, the continuance of their runs seems to be in no danger from any of the circumstances connected with the offal problem. The fact that fresh offal sinks to the bottom gives color to the complaints made in some other regions where bottom fisheries are carried on, but with the salmon, which keep above the bottom and are supposed not to be influenced in their passage by the conditions it displays, the case is very different.

REGULATIONS AFFECTING THE SALMON FISHERY.

WASHINGTON.

The laws of 1890 and 1893, which were in force at the time of the investigation by Dr. Wakeham and the writer in 1895, contained a few excellent measures, but their application being limited by a decision of the court to Puget Sound in its restricted sense, the more northern waters of the State were practically left without regulations. It is understood that this unfortunate condition has been remedied, and subsequent acts of the State legislature, passed in 1897 and in 1899, have introduced many very stringent and commendable regulations regarding the manner of fishing and the localities where the different methods may be used. There is still lacking, however, an adequate close-season law. The latest regulations did not come to the attention of the writer until after the completion of this paper, a fact which will serve to explain the omission of fuller reference to them in the appropriate places. The measures now in force relating specially to the preservation of the salmon in the Puget Sound region are briefly summarized below, the year in which each act was passed being also given:

All that part of tide waters emptying into the Strait of Fuca, and the bays, inlets, streams, and estuaries thereof, shall be known and designated as Puget Sound. (1890.)

The use of pound nets, traps, weirs, fish wheels, and other fixed appliances, purse nets, drag and other seines, set and drift gill nets is permitted in the waters of Puget Sound and its tributaries as provided below. (1897.)

All fishing by nets and fixed appliances is subject to license, a separate license being required for each piece of apparatus. Licenses are issued only to citizens of the United States who are residents of Washington. Each person, firm, or corporation is entitled to only three licenses. (1897.)

The use of pound nets, traps, weirs, fish wheels, and other fixed appliances, except set lines, for the purpose of catching salmon, is prohibited in all rivers flowing into Puget Sound and outside of said rivers within 3 miles of their mouths; also in Deception Pass or within one-half mile of its western entrance, and in any other salt waters of the State at a greater depth than 65 feet at low tide. (1897.)

It is unlawful to use any purse net or other like seine within 3 miles and drag seine within 1 mile from the mouth of any river flowing into Puget Sound or within said rivers. (1899.)

No seine location the title to which is in the State shall occupy a greater space than twice the length of the seine covered by the license. (1899.)

No lead of any pound net, trap, fish wheel, or other fixed appliance for the catching of salmon in Puget Sound shall exceed 2,500 feet in length. There shall be an end passageway of at least 600 feet and a lateral passageway of at least 2,400 feet between all pound nets, traps, weirs, or other fixed appliances. (1897.)

Between all set gill nets there shall be a lateral passageway of at least 300 feet and an end passageway of 30 feet. (1899.)

No fishing appliance or device of any kind located or used upon any streams or rivers shall, either by a lead or any parts of said appliance, occupy more than one-third the width of such streams or rivers. (1899.)

The meshes in all pound nets, traps, weirs, fish wheels, or other fixed appliances for the capture of salmon shall measure not less than 3 inches in extension. (1897.)

It is unlawful to take or fish for salmon by any means except angling above tide water in any of the following rivers: Nooksack, Skagit (up to the town of Hamilton), Stillaguamish, Snohomish, White, Nesqually, and Skokomish. (1899.)

Whenever the Fish Commissioner shall consider that the protection of the food-fishes mentioned in this act (March 13, 1899) shall require it, he may close to fishing any stream or river in this State emptying into Puget Sound, etc. (1899.)

All dams or other obstructions in streams where food-fish are wont to ascend shall be provided with fishways approved by the Fish Commissioner, and it is unlawful to take any food-fish within 100 yards of any such fishway. (1893.)

Throwing into the water any substance deleterious to fish, including the waste from sawmills, and the use of explosives for killing fish are prohibited. (1890, 1891.)

It is unlawful to take salmon in any of the tributaries of Puget Sound during April and from October 15 to November 15 in each year. (1899.)

All young salmon measuring 10 inches long or less which may be taken by any means except hook and line in either Puget Sound or any of its tributaries shall be returned alive to the water. (1893.)

Indians residing in the State may take salmon or other fish by any means at any time for the use of themselves and their families. (1899.)

All moneys collected for licenses and fines under provisions of the fisheries acts shall be turned into the State treasury and placed in the fish-hatchery fund. (1897.)

BRITISH COLUMBIA.

Following is an abstract of the more essential regulations regarding salmon fishing in the Fraser River district, which went into effect May 1, 1894, together with such amendments as have since been ordered:

Commercial fishing is restricted to the use of drift gill nets not exceeding 150 fathoms in length, and to tidal waters, the upper limit of which on the Fraser River is placed at the mouth of the Sumas River.

The drift nets for quinnat salmon shall have not less than 7¾-inch mesh, and can be used only from March 1 to September 15. (By order of June 19, 1897, the limitation upon the size of the mesh of the quinnat nets was reduced to 7 inches, mainly with the object of adjusting them to the capture of the steelhead and silver salmon.)

The drift nets for other kinds of salmon shall have not less than 5¾-inch mesh, and can be used only from July 1 to August 25, and again from September 25 to October 31.

All commercial fishing for salmon is prohibited weekly from 6 a. m. Saturday to 6 p. m. Sunday, and annually from September 16 to 25, and from November 1 to March 1.

Drift nets shall be kept at least 250 yards apart, and shall not be used so as to obstruct more than one third the width of the river.

Above tidal waters the only net fishing permitted is the use of dip nets by the Indians to provide food for themselves and their families. The Indians, however, are required to respect the spawning-grounds of salmon and the close seasons.

Fishing can be carried on only under license, except in the case of Indians fishing to supply their own wants.

Commercial licenses to fish for salmon are granted only to *bona fide* fishermen who are British subjects and residents of British Columbia, or to any company, firm, or person dealing in salmon when each member of such company or firm or such person is a British subject.

Fishermen are entitled to 1 license each; dealers in fresh, frozen, salted, cured, or smoked salmon for domestic or foreign trade are entitled to 7 licenses each; canneries are entitled to 20 licenses each. (Canneries were restricted to 10 licenses each by orders of August 3, 1898, and March 29, 1899.)

Every farmer or settler actually residing on his lands or with his family, being a British subject, is entitled to 1 "domestic" license, which gives him the privilege of fishing for his own use in any of the waters of British Columbia, subject to certain restrictions as to nets, prescribed limits, spawning-grounds, and close seasons.

The capture and retention of any salmon under 3 pounds in weight is prohibited.

The use of firearms, explosives, spears, torches, or other lights to kill fish is prohibited.

No deleterious substances are allowed to be thrown into or to enter the water where they would be prejudicial to the fisheries. Under this category is included fish offal, the throwing of which into the Fraser River is prohibited by regulation. Its disposal is provided for in the Fisheries Act as follows: That it may be buried ashore beyond high-water mark, and that at establishments situated inside of the mouths of rivers for carrying on deep-sea fisheries the same may be dropped into perforated boxes or inclosures built upon the beach or under stage heads, in such manner as to prevent the same from being floated or drifted into the stream, or may be disposed of in such other manner as any fishery officer prescribes.

Fishways shall be provided at every dam, slide, or other obstruction across or in any stream where the Minister of Marine and Fisheries determines it to be necessary for the public interest.

STATISTICS.

Salmon catch of the Puget Sound district of the State of Washington.

[Compiled from the reports of the United States Fish Commission and the State Fish Commissioner of Washington.]

Years.	Quinnat.	Sockeye.	Silver.	Humpback.	Dog.	Steelhead.	Total.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1888	....	....	....	....	....	....	2, 036, 250
1889	96, 228	....	1, 388, 495	283, 042	366, 117	90, 570	2, 224, 452
1890	132, 183	....	1, 093. 822	....	854, 973	172. 460	2. 253, 438
1891	202. 675	522, 760	1, 414 010	715, 061	965, 911	209, 320	4, 029, 737
1892	285. 748	274, 225	1, 836, 904	....	2, 691, 425	261, 142	5. 349. 444
1895	1, 405, 047	6, 532, 207	9, 100, 675	2, 269, 766	4, 578, 540	1, 965, 552	25, 851, 787
1896	....	....	....	....	....	....	*15, 000. 000
1897	....	....	....	....	....	....	42. 725. 000
1898	....	....	....	....	....	....	32, 213, 000

NOTE.—The figures for 1896, 1897, and 1898 are based upon the returns given in the reports of the State fish commissioner, and are only approximate. Those for 1896 are probably in error, being evidently too low.

Salmon cannery pack of the Puget Sound district of the State of Washington.

[Compiled from the reports of the United States Fish Commission and the State Fish Commissioner of Washington.]

Years.	No. of canneries.	Quinnat.	Sockeye.	Silver.	Humpback.	Dog.	Total.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1889	2	15, 648	....	486, 192	182, 592	74, 448	758, 880
1890	1	3, 984	....	238. 944	....	200, 112	443, 040
1891	1	24, 816	360, 000	381, 504	367, 056	201, 024	1, 334, 400
1892	2	5, 616	192, 000	489, 984	....	1, 051, 728	1, 739, 328
1893	3	57, 600	2, 296 896	566, 976	841, 440	546, 240	4, 309, 152
1894	4	....	2, 005, 488	1, 076, 064	* 434, 352	1, 063, 296	4, 579, 200
1895	5	74, 016	3, 126, 864	2, 441, 520	1, 134, 384	1, 861, 680	8, 638. 464
1896	11	647, 760	2, 502, 992	3, 966, 720	....	1, 274, 400	8, 391, 872
1897	12	456, 000	14, 978, 304	4, 411, 200	2, 748, 864	1, 118, 880	23, 713, 248
1898	18	537, 600	12, 096, 000	4, 732, 800	....	1, 843, 200	19, 209, 600

* These figures are given in the tables of the United States Fish Commission (Report for 1896, p. 581), although no humpback salmon could have been taken that year.

Statistics of the British Columbia salmon fishery of the Fraser River, Gulf of Georgia, and Strait of Juan de Fuca.

[Compiled from the annual reports of the Department of Marine and Fisheries of Canada.]

Year.	No. of drift-net licenses.	Total length of drift nets.	No. of canneries.	Output of canned salmon.	Quantity of salmon sold fresh, salted, and smoked.	Total salmon catch.
		Yards.		*Pounds.*	*Pounds.*	*Pounds.*
1876	....	....	3	511, 056	96, 200	777, 608
1877	285	44, 040	5	3, 090, 576	690, 200	4, 810, 968
1878	449	114, 580	8	5, 044, 880	1, 010, 200	7, 736, 707
1879	304	65, 600	7	2, 423, 520	157, 300	3, 388, 660
1880	274	105, 240	7	2, 023, 440	413, 580	3, 111, 500
1881	396	124, 400	8	6, 840, 768	2, 306. 200	11, 427, 224
1882	666	205, 600	13	9, 561, 972	878, 200	13, 627, 496
1883	764	215, 780	12	5, 265, 648	1, 170, 600	8, 191, 464
1884	702	210, 770	6	1, 844, 976	1, 720, 560	4, 180, 528
1885	655	189, 200	6	4, 301, 616	2, 395, 600	8, 131, 088
1886	734	232, 920	11	4, 758, 576	842, 350	7, 187, 118
1887	935	350, 850	12	6, 182, 688	1. 954, 600	10, 198, 184
1888	....	282, 520	12	3. 677, 568	2, 375, 400	7, 278, 824
1889	....	254. 200	16	14, 789, 856	2, 620, 700	22, 340, 508
1890	....	298, 880	17	11, 742, 600	1, 898, 100	17, 554, 900
1891	....	244, 810	22	8, 527, 552	2, 117, 153	13, 487. 222
1892	....	252, 580	22	4, 277, 552	2, 893, 309	8, 596, 712
1893	....	355, 900	26	22, 763, 380	4, 197, 700	34, 548, 873
1894	....	503, 900	28	17, 451, 172	2, 190, 500	25, 458, 729
1895	....	528, 000	31	20, 780, 170	1, 871, 992	29, 578, 885
1896	....	803, 800	35	18, 016, 544	1, 249, 695	25, 271, 754
1897	....	709, 400	43	42, 197, 516	2, 777, 669	59, 041, 024
1898	....	....	....	9, 600, 000	....	....

NOTE.—This table is based upon the reports of the inspector of fisheries for British Columbia as published in the annual reports of the Department of Marine and Fisheries of Canada. No data are available for determining the part taken by the hook-and-line fishery in the salt waters. In computing the total annual catch, the figures for which are only approximate at best, an allowance of one-fourth in weight is made for waste in the preparation of the canned salmon. A barrel of cured salmon is reckoned at 200 pounds, and fresh salmon have been estimated to average 10 pounds each where the records show the number marketed instead of the weight. This total catch relates almost exclusively to the salmon utilized in trade, both foreign and domestic, although some part of the fresh salmon may have been taken by the catcher to supply his own wants.

The quantity of salmon caught and used by the Indians is said to be very large, generally much exceeding the amount secured for market, though undoubtedly consisting in greater part of inferior species. Exact figures are not obtainable, but in 1886 or previously the quantity was estimated at 25,000,000 pounds annually, and these figures or their money equivalent were repeated in the official reports for several subsequent years. They were afterwards discontinued, however, as having too little foundation in fact.

SUMMARY.

In the account that has gone before, the conditions presented by this region are shown to be, from a fishery standpoint, both varied and perplexing—varied as to its natural features and resources, and perplexing in the division of its waters between two distinct countries. A long, deep, and rugged arm of the sea, fed by many mountain streams, invites a host of fishes from the ocean to seek shelter, food, and spawning-grounds. So closely does it resemble the outer coast in the purity, salinity, and coolness of its waters, that its fishes are identical, while the character of its surroundings greatly increases the opportunities for their capture. Among the useful species which enter here are several of anadromous habit, which occur in extreme abundance, being represented by one form or another throughout nearly the entire year.

It is doubtful if any other known region of no greater size affords so rich an assemblage of aquatic products or offers so many inducements for remunerative employment in their pursuit. To retain these benefits, so important for the region, will require the exercise of a wise forethought by those in power, as well as the accomplishment of a still more difficult task, the securing of harmonious action by the two nations whose interests are made inseparable through the extent to which the more prominent fishes cross the boundary line. As regards the salt waters the resources seem to be about equally divided between the two countries, but Canada has much the greater advantage in the matter of rivers, not in point of numbers, perhaps, but in the possession of the Fraser system, one of the most extensive resorts of salmon in the world.

While no marked decrease in the abundance of any species, except in two or three instances, has so far been positively recorded, experience teaches that in waters such as these a decrease is certain to appear unless due precautions are taken to prevent it, and they should be both timely and effective. Some of the open-sea fisheries in the North Atlantic Ocean have been prosecuted for centuries without apparently diminishing the supply, but the number of these is comparatively small. As a rule, man's influence has been felt, its extent varying with the natural limitations upon the movements of the fishes which are sought, the perfection of the fishing methods, and the persistence with which the latter are employed. The more restricted a fish's habitat, the smaller the sheet of water or the narrower the river, the more readily, in general, may the species be caught out. In conformity also with the same conditions are generally the opportunities for organizing systems of protection which shall be adequate to insure the perpetuity of each fishery.

A thorough regulation of the fisheries does not, however, imply a return to primitive or inferior methods of capture. There can be no reason for prohibiting the more perfect kinds of apparatus which are not actually vicious in their effects, provided the quantity of fish allowed to be taken is properly restricted. In the competition which pervades all industries it would indeed be unwise to require adherence to old-time practices, whereby the price of fish would be proportionally increased above that of other classes of our food supply.

It is to be recalled in this connection that the fishery products of a country are, as a rule, the property of the public as represented by the state or sovereign, despite the very prevalent idea that they belong solely to those who seek them. The fishermen rank practically as tenants, at some times paying for their privileges, at others not, when their status is more like that of a squatter on the public lands. Considering the ignorance or indifference with which the matter has always been treated by the people and the fishermen alike, it is not surprising that most of the older fisheries within restricted areas have been so greatly despoiled, and that newly discovered ones should be looked upon more for the opportunities for speculation they afford than as resources which can and should be made lasting.

The trouble arises chiefly from the fact that, except in a few respects, water territory can not be managed in the same manner as the land, in regard to which the individual is held primarily responsible in the economy of government. The land, for instance, is customarily divided up and passes under private control for such purposes as those of agriculture and mining. Crops are sown and harvested and rock products are extracted as suits the needs or pleasure of the possessor of the ground. The extent to which his industry is carried requires the dictates of no other law than that of self-preservation or advancement. Should he be neglectful or wasteful it redounds to his own injury, while with thrift and care his returns may be many times increased. If he fails in his obligations to himself the community as such is not supposed to suffer.

With regard to the fisheries it is very different. While certain sedentary products of the sea, such as oysters, may be farmed out, so to speak, and small ponds and streams may be treated as individual belongings, the great bulk of aquatic animals is not subject to private management. Most fishes, and especially those of much commercial value, are wanderers, whose confinement within artificial barriers is impossible. Thus, were the fisherman to plant, his crops would be shared by all alike; he could neither inclose them nor define them, nor would his personal efforts be of any avail in promoting the general welfare. The fisheries must, therefore, be administered upon by the state as a common holding, and the laws relating to them must not only regulate the behavior of those who participate, but also limit and define the extent and manner of their participation. This is entirely in line with the state control of waters for all other purposes, such as navigation, and in conformity with the customs of all nations.

It is, of course, to be understood that these remarks do not apply to extraterritorial waters, which are generally conceded to be outside the jurisdiction of any country, although several countries may unite in concerted action for their protection. And, furthermore, it is to be remembered that the Federal Government of the United States has not heretofore concerned itself with the regulation of the fisheries, except in some special cases, leaving to the individual States the entire control of such matters.

In the region to which this paper relates there may still be time to give the fisheries the full benefits of a wise protection before any of its branches shall have been appreciably impaired, but action should not be long deferred, as a decrease once begun is hard to check. The urgency of the matter is emphasized by the fact that elsewhere fisheries of the same character as the more important ones here have been among the first to suffer from indiscretion, and it is not to be expected that this region will furnish an exception to the rule. Of the regulations already in existence some are excellent, but as a whole, and more especially in Washington, they still fail to meet certain most essential requirements. In view of the fact that only a few branches of fishing are immediately concerned, however, not many additional laws are necessary at present, but it is very important to begin upon a course of procedure that shall be logical, and consequently effective. It is not suggested to carry the restrictions to a point where they would be either oppressive or unjust, but chiefly to establish a proper system of limitations before the strain upon the local resources shall become too great.

Unfortunately there is little definite information as a basis for legislative action, though possibly sufficient for the time in the directions where most urgency exists. It is, therefore, of the greatest importance to institute without delay a detailed and comprehensive investigation of the fishery products of the region with reference to their natural history and the extent to which their pursuit may safely be carried. The laws governing their capture can be perfected only in proportion to the sum of knowledge derived from such studies, which will also serve the further purpose of making these resources better known and of indicating new channels for their development.

Before passing to the special considerations which follow, it may be well to explain, what seems not generally to be understood even by many of the older fishermen, that the inland salt waters of this region are entirely divided between the two adjoining countries, leaving no intervening high sea open unrestrictedly to all comers. From the mainland at Point Roberts the boundary line extends due west partly across the Gulf of Georgia, and thence midway through the Canal de Haro and the Strait of Juan de Fuca to the ocean. The United States on one side of this line and Canada on the other have each complete jurisdiction over its share, whether navigation, the fisheries, or other subject is concerned.

For convenience of discussion, the useful fishes of the region may be arbitrarily classed in three groups: First, those which exclusively inhabit the salt water; second, those which belong entirely to the fresh water; and, third, those whose habit causes them to make periodic migrations between the sea and the rivers.

The salt-water fishes present the greatest number and diversity of forms, but only a few now figure at all prominently in the catch, and the majority may be regarded rather in light of a reserve stock, which will be drawn upon more and more with the increase of local population. In only one direction, probably, has the fishery progressed sufficiently to give cause for concern, and as a whole the resources of the group, so far as can be judged, may be considered as in good condition. The halibut is at present the most important of the marine species, chiefly because of the large demand for it in eastern markets. It has always been a favorite food with the Indians and one of their principal objects of pursuit, but there is no reason to suppose that its abundance was in any way affected until long after the advent of the whites. The rapidly growing trade recently inaugurated, however, has caused a heavy drain upon the different grounds tributary to the region, and while the large shippers depend almost entirely upon the outer and more extensive sources of supply, yet the inner grounds have had to stand a more active fishery than before; and as they are small, scattered, and relatively few in number, have quickly felt the effects of overfishing, a very appreciable decrease being reported. A remedy will be difficult to find, owing to the indefinite character of the fishery, but some restriction should undoubtedly be placed upon the quantity of fish taken.

Attention should also be given to the oysters, of which the supply can readily be increased and the quality improved by artificial cultivation. The fisheries for crabs and shrimps, and possibly for clams likewise, need supervision, the crustaceans being especially subject to depletion.

The purely fresh-water fishes are of very much less importance than either of the other groups. Among them are no species of extensive commercial value, but their protection is particularly desirable in the interest of local markets and sport fishing. International action is scarcely called for, however, unless it be to provide jointly for the enforcement of regulations to prevent illegal shipments across the border. In considering this group, the fact should not be lost sight of that the trout are among the worst enemies of young salmon, and that, in a region whose industrial prosperity is so largely dependent upon the salmon fishery, it would be unwise to jeopardize the latter for the sake of the trout.

The third group consists of the anadromous fishes, whose most conspicuous members are the salmons. The sturgeon also occupies a prominent place, the eulachon is locally important, and the Atlantic shad seems destined to gain a foothold. While it may yet be too early to take action regarding the species last named, the protection of the eulachon is of sufficient moment to be made the subject of inquiry.

While the supply of sturgeon is presumably still intact, this bulky fish, whose value is so greatly enhanced by its caviar, has been the first to suffer in each new fishery of which it has formed a part, and its early elimination from each as a prominent factor has been the rule. Attention here has been so closely concentrated upon the salmon, and the difficulties in the way of marketing the sturgeon have been so great, that the latter has been little fished for until within a few years. Its abundance, however, and the readiness with which it may be captured in both the fresh and salt water presage for it an extensive fishery, which has already taken form on the Fraser River and possibly elsewhere. In the salt water it is mainly caught incidentally in connection with the salmon, but with better means of disposing of the catch it is certain to be sought for specially.

The protection of the sturgeon may, in a measure, be secured by prohibiting the capture and sale of any but the mature sizes, by making reservations of the spawning-grounds, by instituting close seasons, and by restricting the amount of fishing. The Washington law of 1897 makes a close season from March 1 to November 1 and forbids the use of young sturgeon less than 4 feet in length. In British Columbia there is a general close season from June 1 to July 15 and a weekly close time corresponding with that for the salmon. Fishing is limited to the use of gill nets, drift nets, and baited hooks, the nets being not longer than 300 fathoms and having not less than a 12-inch mesh. They can not be set less than 250 yards apart. Not more than 6 hooks can be attached to each fishing line, and sturgeon under 4 feet long must be returned alive to the water.

The salmons, much more than any other fishes, demand immediate and serious consideration, as they constitute by far the most prominent fishery resource of the region and furnish the bulk of all its fishing. Without them the fisheries here would never have attracted special attention, and should they ever meet with the mishaps which seem elsewhere to have been the inevitable result of civilizing influences this industry must certainly become of comparatively slight importance. Not all the other species combined could nearly take their place as a source of local revenue.

The quantity of salmon which frequents these waters is beyond calculation, and seems even to be so great as to challenge human ingenuity to affect it in any way; but upon reverting to the conditions that existed in the northern Atlantic rivers less than a century ago we are led to recognize the omnipotence of man in this direction at least. The destruction there, to be sure, was due only in part to overfishing, but to-day the demands are much greater and the fishing engines more powerful. The catch need not reach the consumer immediately, but may be stored awaiting his pleasure or a rise in prices, and may be shipped, without injury, to the remotest quarters of the world. Such activity in the salmon fishery as now pervades this region, in common with the Columbia River and the Alaskan coast, was not dreamed of a few decades ago, and its effects are not measurable by the older standards. In this particular locality the growth of the industry has recently been much accelerated, and with the experience now acquired an increase in the catch from year to year is readily assured and will as manifestly be demanded. The question is, Where will it end? The circumstances have been so unusual that time alone can solve the problem. There appears so far to have been no appreciable decrease in any of the species, but, however abundant each may be, it seems impossible that this condition could continue long.

The situation presented by the salmon fishery is briefly as follows: Six species of the group occur in this region, all edible and of commercial value, but graded for the market in accordance with the quality, the color, and the firmness of their flesh. The quinnat and the steelhead are preferred for the fresh trade and the sockeye for canning. The silver salmon, the humpback, and the dog salmon are utilized in various ways, but whether fresh, salted, or canned they constitute an inferior grade and generally sell at a lower price.

With the variety and abundance of its salmon the region combines physical characteristics which greatly increase its importance as a producing district. Its rivers, instead of emptying on an open and exposed coast, have between them and the ocean a large and quiet sea, with many long channels, through which the fish must pass in the journey to their spawning-grounds. The advantages of this intermediate body are two-fold, in that it greatly enlarges the fishing area and brings the fish of every species in striking distance while still in the salt water, when their condition is certain to be good. With these unusual opportunities for following up the schools the necessity for adequate regulations must be manifest to all. The more important forms are naturally most actively and persistently sought after, leaving the others somewhat in reserve, but not to such an extent as the general accounts might lead one to suppose. The silver, humpback, and dog salmon are all employed for canning on the United States side, and throughout most of Puget Sound proper they are the only species which can be secured in sufficient quantity for that purpose. Any system of protective regulations should therefore contemplate providing for the welfare of the entire salmon group; but with some species there is much greater urgency for action than with others.

Among the salmon, and in fact among all the fishes of the region, the sockeye occupies the place of most prominence. While it holds this position primarily by virtue of the deep color and excellent canning quality of its flesh, its importance is equally due to its exceeding abundance, greater in most years than that of any other species in the localities it frequents, to its regular and well-defined movements, and to its relatively early season, which insures the passage of most of the schools past the fishing-grounds quite well in advance of the spawning period. The principal disadvantage under which the species labors arises from the fact that its spawning-grounds are almost entirely restricted to two rivers, and in greater part to one, the Fraser. After entering through the Strait of Juan de Fuca its course is so well known and its presence so readily detected in many favorable localities that it is compelled to run the gauntlet of a very active and persistent fishery, which is stimulated by both local and international rivalry. While the movement of the species may not continue over five or six weeks, the amount and effectiveness of the apparatus employed for its capture more than counterbalance the shortness of the season. Every year adds new fishing stations and increases the quantity of nets about the older ones at a rate that threatens overfishing at an early period.

While the main body of the sockeye passes north through the two channels on either side of the San Juan Islands, no noteworthy fishing sites had been discovered south of Lummi Island at the last report. The next and by far the best of the Washington grounds are about Point Roberts, the principal trap-net locality, where the question of greatest interest is to determine what proportion of the fish moving about the point strike within the range of the long strings of nets. The Canadian fishery is concentrated in the discolored water of the Fraser River from above New Westminster to some distance off the delta, where the conditions are such, moreover, that the entire run of sockeye might be practically wiped out by an extreme multiplication of the drift nets. In fact, in its possession of the Fraser River British Columbia controls the main situation as regards this species, having within its power the means of inflicting an incalculable amount of harm; while, on the other hand, the preservation of the sockeye requires the concerted action of both countries.

The conditions are more serious in regard to the run of sockeye which passes through Skagit Bay and into the river of the same name than with the northern run. This is chiefly due to the narrow and shallow character of the bay, which permits the arrangement of a close network of apparatus, and judging from late accounts the fishery there is being pushed with great persistency and with little thought of the future. Any and all kinds of nets may be employed, which, in a restricted area, is a great misfortune, and in other ways the laws are also quite inadequate.

The feature of periodicity in the relative size of the annual runs of sockeye is of great interest, and its causes have given rise to much conjecture. Should its origin have been due, as some suppose, to local influences affecting the species at its spawning-grounds, it would point to a source of menace in that connection, but time has shown that there is little occasion for anxiety on that score, and if the efforts now being made to equalize the runs through artificial propagation turn out successfully, all such natural dangers will be minimized.

A much more important phenomenon is the great mortality which affects nearly all salmon at spawning time, and in the case of some species seems to work an almost total destruction, the sockeye being one of the heaviest sufferers in this respect. This mortality has a practical significance in that if none of the ascending fish are to return again to the sea there is no occasion for protecting them with the object of saving any for subsequent fishing seasons, and all that need be done is to assure a sufficient run past the nets to provide for the requisite amount of spawning.

With the information now at hand, however, no measure can be set upon the quantity that should reach the spawning-grounds, and for some time at least, if not forever, the question must remain entirely problematical, the only safe course to pursue being to allow the widest margin possible.

The quinnat has not the same position here that it holds on the Columbia River, in consequence of its being apparently less abundant and also because of the large proportion of off-colored fish, which has made its pursuit less active than would otherwise have been the case. Nevertheless it ranks as the most important species for the fresh market, for which purpose it is principally used, its employment for canning during the season when it is chiefly taken being made impracticable by the high prices which then prevail. The introduction of stock from the Columbia River, with the object of securing a larger run of the deeper-colored fish, was contemplated by the Canadian government some years ago, but the plans were never carried out. The experiment would have been watched with keen interest, in view of the problem involved as to whether the lighter coloring of so many individuals is simply due to local influences which might also affect the imported fish.

The rapid growth of the fresh trade is strongly stimulating the fishery for the quinnat, and its welfare should be carefully looked after in the salt water and the smaller streams, as well as in the larger rivers where its pursuit is naturally most extensive.

The steelhead is also chiefly utilized in a fresh condition, the fishery being mainly a winter one in the lakes and rivers, although catches are made at other seasons and to some extent in the salt waters. Its predaceous tendencies and supposed habit of feeding on the young salmon of other species have been suggested as sufficient reasons for denying it all protection, but it would be exceedingly unwise to act upon this proposition until its life-history has become better known. In British Columbia the general provision against winter fishing for any of the salmon has interfered with but not wholly prevented the capture of this species at that time of year. The circumstances show the necessity for regulating its fishery on a different basis from the other forms.

Of the remaining members of the group the silver salmon is the most important and is the one most likely to be drawn upon in making up a shortage in the cannery pack of sockeye. It is most extensively utilized south of the boundary line, where the principal catches are obtained by means of purse seines in the salt water. It is also taken in the trap nets, when left out late enough in the season, and by other methods.

While the humpback, whose appearance is strangely confined to alternate years. and the dog salmon have a lower standing than the foregoing. yet they are of sufficiently good quality to entitle them to a high rank among the food-fishes of the region. Both are canned to some extent in Washington. The humpbacks are taken in large quantities in connection with the later runs of sockeye, especially in the trap-net fishery, when they are customarily discarded, but not until after they are dead, causing an extensive waste.

The dog salmon seem recently to be meeting with increased favor. Their condition is said to be excellent as long as they remain in the salt water, which is for a considerable period after their first appearance, and they are now being utilized in connection with the fresh trade. The silver, humpback, and dog salmon, like the quinnat, spread to all parts of the inclosed sea and enter most streams, even those of small size. With this wide range of spawning-ground, their chances of survival are much greater than with the sockeye, while the extensive area over which they must be sought in the open-water fishery gives them an additional advantage. The activity of their pursuit, however, is certain to increase, and should there ever be a decided falling off in the supply of sockeye it would be greatly stimulated.

It will be observed, therefore, that while the requirements of the sockeye have already been ascertained with some degree of definiteness, much uncertainty exists as to the amount of protection that should be accorded the other species at the present time. The problem they present is more complex as a whole and will require more study to unravel the details, but there is no reason to suppose that it may not be as satisfactorily dealt with. None of these species, unless it be the quinnat and steelhead, seems to be in immediate danger, and if the ordinary precautions which should be taken in regard to any salmon fishery, such as safe-guarding their spawning, be immediately enforced, detailed regulations in respect to other matters can possibly await further investigations, if not too long delayed. The primary requisite in the protection of salmon is that they shall have such freedom of access to their spawning-grounds as will insure the perpetuation of the species without decrease. This provided for, it makes little difference, as regards the welfare of the species, how or where the fishery is carried on.

It is unfortunately impossible to determine what proportion of any run of fish may safely be taken, and it would probably be impracticable to utilize that information were it obtainable. While theoretically any disturbance of the natural supply might be expected to cause a decrease, experience teaches that a certain amount may be removed each year without appreciable effect, as instanced by the large Indian fishery in this region, which has been going on from time immemorial. Between the practices of the Indians and those of the modern fishermen, however, the difference is very great, and it is with the latter that we have now to deal.*

Commercial fishing for salmon has become extensive in this region only within a comparatively short period, but while in Canada it has been practically restricted to drift-netting, in Washington nearly every form of apparatus known to be adapted to the purpose has already come into use. Trap nets were the latest to be introduced, but are now recognized as the most effective kind in salt water. Purse seines came next before the traps, and are probably to be considered as only second to them in importance. Still older are the drag seines and gill nets, the latter employed in both the salt and fresh water. Hook-and-line fishing is one of the minor salt-water methods, applicable only to the capture of the quinnat and silver salmon, but much of the local supply during some seasons is obtained by this means.

The Indians still use their reef nets along the route of the sockeye, and their spears and dip nets in the upper river courses, where at times they also build a small and rude form of weir. Wheels have been tried in one place, but they seem unlikely to gain a foothold here. While in principle there can be no objection to the employment of all the legitimate forms of apparatus, the Canadian system has the greater advantage from the standpoint of protection, in that a much simpler code of regulations suffices. It is to be borne in mind, however, that the Washington fishery is prosecuted under greater diversity of conditions, and to restrict it along a single line would mean its curtailment many fold, an extreme measure which would not be justifiable.

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* Since this paper was prepared we have received a copy of the report of the State fish commissioner of Washington for 1898, from which are taken the following extracts regarding the salmon fishery for 1898 and the supposed evidences of a decrease in certain streams. Should the statements concerning decreases be well founded the necessity for decisive action by the authorities of Washington is more pressing than the evidence in the possession of the writer had led him to suppose:

"The report from the district of Puget Sound shows a still more marked decrease in the output in the salmon fisheries than does that of the Columbia River. The enormous run of Fraser River salmon during the season of 1897 increased the annual output of this district to a remarkable degree. * * * The run of other classes of salmon for the season of 1897, with the exception of the Fraser River fish, was not materially larger than in former years. The decrease in the output of the past season is entirely in the early runs of salmon. The fall varieties show an increased catch over the year 1897. The increased fall output was largely due to the shortage of the spring catch and energetic work on the part of the fishermen and canneries to make up for the spring shortage by a large pack of the fall varieties. * * * The numerous streams tributary to Puget Sound have in years gone by teemed with what seemed to be an inexhaustible supply of salmon, and while in a number of these streams the supply does not seem to have diminished materially, in many of them there has been a wonderful decline, so much so that complaints during this season, and even during the season of 1897, when there was a phenomenal run of sockeye salmon on the sound, have come to us from different localities in which a great decrease of the run of fish on certain streams has been noted. During the season we have examined some 14 different rivers tributary to the sound, with a view to better understanding the conditions prevailing with regard to the run of fish, and also for locations available for the establishment of hatcheries. In every instance, from the people and fishermen living along the streams, has come the complaint of remarkable decrease in the run of salmon. While this may be attributed to some extent to an off year, yet we find that during the season of 1897 very much the same conditions prevailed in many localities."

Except for a small amount of hook-and-line-fishing in the salt water, drift gill nets are the only appliances allowed in the commercial fishery for salmon in this part of British Columbia. Their use is, moreover, almost entirely confined to the lower tidal portion of the Fraser River and that part of the Gulf of Georgia immediately adjacent to its mouths, where the salmon runs are very much more extensive than elsewhere, and where the discolored water effectually hides the twine during most of the open season. Although there is room for the expansion of this fishery to an almost unlimited extent, and certainly to the imminent danger of exhausting its resources—a condition which might apply, however, to any effective method adapted to the same surroundings—yet the simplicity resulting from the use of only a single kind of net makes the system most amenable to regulative measures and one greatly to be preferred. For the drift net, as compared with the trap and purse seine, the benefit is also claimed of dividing the fishery among the greatest number of fishermen, thus providing a means for preventing a monopoly of the work by the larger operators.

Experience has shown the necessity for only two kinds of these nets, distinguished solely by the size of the mesh—a larger one for the quinnat and a smaller one for the sockeye and other species of corresponding size. The former may be employed without interfering with the smaller salmon, the latter without taking the larger forms, and thus an opportunity is afforded for treating the two groups apart, for closing the fishery for one while the other remains in season. The length of the net in both classes is limited by law to 150 fathoms, and the depth, by custom, to about 50 meshes. These dimensions are reasonable and convenient for handling by the small boats employed in their use.

Formerly a limitation was placed upon the total number permissible in the Fraser River district, which up to 1891 never exceeded 500. Then all restrictions of this character were removed, and every bona-fide fisherman who was a British subject and a resident became entitled to a license. Canners and dealers could obtain from 7 to 20 licenses apiece, though the limit to canneries was reduced in 1898 to 10. The effect of this modification of the law was felt at once, for in 1892 the number of nets increased to 721, and in 1893 to 1,072, in 1894 to 1,666, and in 1895 to 1,733. In the last-mentioned year the total length of the combined nets amounted to 523,000 yards, while in 1896 it had reached 800,000 yards. The principal weakness in the Canadian regulations is in regard to this provision, which practically admits of an unlimited extension of the fishery. The claim is not here made that the number of nets has already become excessive, though possibly it has, but extreme watchfulness is necessary to keep the quantity within proper bounds. A part of the recent great increase in the nets is ascribed to the hard times prevailing in connection with other pursuits which has led to an influx of many inexperienced fishermen, whose catch is said to have been relatively small. The power exerted by the large amount of netting is strikingly illustrated in the year of big runs of sockeye, when the catch becomes enormous and sometimes far exceeds the capacity of all the establishments—including the canneries—concerned in preparing the fish for market. Considering the shortness of the season, the size of the fishery is all the more remarkable.

The manner of using the nets on the Fraser River is also subject to certain regulations. They must not, for instance, obstruct more than one-third the width of the river and must be kept at least 250 yards apart. These measures are designed to maintain an open passageway for the salmon, in which they are protective, and also—the latter one at least—to prevent one fisherman from interfering with another. In principle they are correct, and they would also be good in practice, except that it has not been found possible to carry them out effectively, especially since the nets have become so numerous. Moving continuously as they do, they are to a large extent uncontrollable, while the tendency to concentrate the fishing over a small area near the river mouths leads to some crowding. In some places the river channel is not large enough to leave two-thirds of its width free when the net is placed, and again it is entirely possible to alternate the nets so as to virtually negative the intent of the law.

Although gill nets were among the earlier appliances utilized in Washington, they have never been employed there as extensively or systematically as in British Columbia. They are used in both fresh and salt water, either set or drifting, as suits the pleasure of the fishermen, and are subject only to restrictions governing their distance apart and the width of the river which they may occupy. In certain places, as in Skagit Bay and River, they have become a prominent feature, and their number may be expected to increase. In Skagit Bay competition with the trap nets has engendered an intensely bitter feeling, leading to a strenuous though ineffectual effort on the part of the gill-netters to secure the abolition of the larger nets.

The use of trap nets is prohibited in British Columbian waters, except in the upper part of Boundary Bay, where the fish taken are headed toward the neighboring traps across the line. Within the past few years these nets have become a prominent feature in Washington, where they rank as the most effective apparatus employed in the salt water. Their introduction had special reference to the sockeye, which had previously been mainly fished for in sheltered places along the shores with seines and gill nets. They met with very indifferent success at first, but experience soon dictated the necessary changes in construction and position to insure good catches. The earliest trials were made at Point Roberts, which has proved to be by far the most profitable location for their use, and where their number has always exceeded the total number elsewhere. The other principal fishing-grounds are near Village Point, on the outer side of Lummi Island, the southern end of San Juan Island, and Skagit Bay, all lying in the pathway of the sockeye runs.

In the protection of this species, the one most urgently requiring such attention, the trap nets, therefore, figure most conspicuously and the importance of fixing their proper limitations will very readily be appreciated. With suitable restrictions upon the manner of their employment, the greatest danger lies in the tendency to multiply their number unduly, and in this direction there is reason to fear that much harm may soon be done. The trap nets are mostly located in exposed positions, where it is necessary to construct them of unusual strength, but in spite of this precaution they seldom last a single season without repair. They are consequently expensive to build and operate, which places them beyond the means of the ordinary fishermen, and are in fact almost exclusively run by the canneries or directly for them. In size they generally much exceed the pound nets of the Great Lakes, after which they were originally patterned, and, with the improvements recently introduced, are certain of securing large catches whenever the sockeye are abundant. Thus perfected, they have greatly cheapened the cost of capture and produced a sharp competition with the gill-net interests on the Fraser River as well as in Skagit Bay. The efforts made by the gill-netters in the latter locality to secure the prohibition of trap-net fishing throughout the Puget Sound region had apparently no reference to the preservation of the salmon, but seem to have been directed solely against the larger fisheries, to which the great prosperity of the region in recent years has undoubtedly been chiefly due.

The number of trap nets that might safely be allowed in connection with the sockeye fishery depends upon information not yet available. It was not supposed that there were too many in 1895, when they were last studied, but a very large increase has taken place since then and the limit of safety may have been passed. The danger is most imminent in Skagit Bay, where the run of sockeye is much smaller than toward the Fraser River, and where the opportunities for establishing trap nets are exceptionally good. In this narrow and shallow area these devices, supplemented by other forms of apparatus, may readily be so multiplied as practically to barricade the way toward the river, preventing not only the sockeye but the silver salmon as well from reaching their spawning-grounds, and virtually breaking up the runs in this locality.

If, as claimed, scarcely any young salmon are ever taken in the traps, the question of the size of mesh is not material, unless it be in the interest of other and smaller fishes which may be caught in the same connection, but regarding which we have received no positive information. The mesh should certainly not measure less than 3 inches in the crib and 6 inches in the leaders. A somewhat larger size could probably be employed without detriment to the salmon catch, but floating seaweed is abundant in the region and the larger the openings the more readily these weeds become attached to the net, weighing it down and closing the meshes. The size of the crib is of practically little importance compared with the length of the leader and the scope of the wings, by which the capacity of the net is chiefly to be measured, because however large the crib may be it will only receive the fish which are directed toward its opening. Two thousand feet is as great a length as should ever be allowed for the leader, and in some locations this would be excessive. It may also be found advisable to limit the size of the wings, for they are practically only adjuncts of the leader and of great effectiveness.

But however important it is to restrict the size of the nets, it is still more important to regulate their arrangement or relations to one another when several are fished in the same place. It is a common practice in many localities to join such nets in a string of from two up, according to the width of bottom suited to the purpose. Pound nets on Lake Erie have been thus combined to cover a distance of even 8 or 10 miles without a single break. The longest string in the Puget Sound region in 1895 consisted of three nets at Point Roberts, which extended off from the beach somewhat over a mile. The effect of this arrangement is evident. Over the width which the string occupies substantially every salmon coming toward it is destined to become entrapped. There is little chance for any to escape and a very poor showing for succeeding traps near at hand. Again, though they be not in strings, they may so alternate in position that the salmon which pass one net strike directly against the leader of another. Thus the interests of the fishery demand, where a number of nets are operated near together, that their distribution be so fixed as to permit a fair proportion of the salmon to work their way from among them. Otherwise, with the rapid multiplication of traps which is going on, a time may come when the progress of the salmon will be so barred at intervals as to prevent their ever reaching the Fraser or Skagit rivers. This at least applies to the fish which skirt the shores, and it seems reasonable to suppose that a large share do so at one point or another. In any event, it would be quite injudicious to subject too large a proportion of the fish to capture at any single place. The matter may be definitely regulated by statute as regards the strings, but in respect to the alternating arrangement a consideration of local conditions may be required in each case.

The opportunities are few for a lineal arrangement on the Washington coast, and it is doubtful if any string could be advantageously extended beyond the distance given for the long line off Point Roberts. It was suggested by the Joint Fisheries Commission in 1896, however, that the proper limit has there been exceeded, and that no more than two nets, with leaders not over 2,000 feet long in each, should be allowed in any string. Between the two nets, moreover, there should be an opening, a means of escape for a part of the salmon, and a passageway for boats. Its minimum width in the regulations submitted was placed at 100 feet. It would be better to make it 500 or 600 feet. And it was further provided that the inner end of any leader should never come into a less depth than 1 fathom at low tide. Laterally successive nets should be separated by at least 2,500 feet, approximately half a mile. The greater the distance in this respect the less are the evils to be expected from any alternating arrangement.

By the act of 1897 the legislature of Washington recognized the justice of these requirements. Besides prohibiting the use of trap nets and other fixed appliances in rivers or within 3 miles of their mouths, as well as in Deception Pass and in water of greater depth than 65 feet, this law limits the length of leaders to 2,500 feet and provides for an end passageway between all traps of at least 600 feet and a lateral passageway of at least 2,400 feet.

The purse seines, though very unlike the trap nets, are nevertheless to be classed with them as having great individual scope and requiring a considerable outlay for their operation. They are chiefly fished in the upper part of Puget Sound for the later-running species, especially the silver salmon, of which they take enormous quantities. Elsewhere they are not much utilized, and in connection with the sockeye fishery they cut no figure, although sometimes set in the neighborhood of the traps at Point Roberts. The purse-seine fishery has not been sufficiently studied to determine how far it should be restricted, but the important part played by these nets in the removal of salmon from the salt water and the almost certain future increase in their number make it desirable that the subject be thoroughly considered. Their use is now prohibited within 3 miles of the mouth of any river.

The drag seine was one of the earliest appliances, if not the first, employed in this region for taking salmon, and its use has been continued and increased. The fishery by this means, however, is mostly scattered and irregular, being mainly conducted on a small scale in different places to meet local wants. In some localities more extensive operations are carried on, as about the mouths of the larger rivers at the period when the salmon begin to enter, and in certain parts of Puget Sound to supply the canneries with fall fish. Some fishery experts regard the drag seine with unqualified disfavor under all conditions, but this universal condemnation is far from merited. While they may possibly be hauled surreptitiously rather more easily than most other kinds of nets, within proper limitations their use is quite as legitimate, and to abolish them here would be to deprive the inhabitants of thinly settled shores of one of their most ready means of securing food. They are not now permitted to be hauled in any river or within a mile of its mouth outside.

The primitive reef nets which well answered the requirements of the Indians, although now used for commercial purposes, are rapidly going out of use, and before many years they will doubtless cease to figure among the methods of the region. With an exceedingly limited scope at the best, no occasion exists for giving them consideration in connection with any scheme of regulations.

Only the quinnat and silver salmon take the bait in salt water and are fished for by hook and line, and this occurs on altogether too small a scale to merit attention from the standpoint of legislation. In fresh water the steelhead is the only species which might be caught in the same manner, but we are not informed to what extent it is so obtained, if at all.

The well-known practice of spearing salmon in the upper, shallow waters of a river, long followed by the Indians, has also been taken up by the whites, and in some sections is extensively resorted to by both for domestic purposes, as well as for making local sales among the settlers. With salmon as abundant as they are at present, the danger from this source is much less than on the salmon rivers in the east, where this method is enjoined. In at least some localities, however, the practice should be limited and possibly forbidden, this being especially the case with reference to those streams in which the sockeye and quinnat spawn. It is also generally so near the spawning time before this method becomes effective that the fish so taken are not in the best condition for food, being unsuited for canning or the market trade.*

Fishing has always been one of the chief occupations of the Indians, one of their principal means of securing food. Though of the wilderness, as the salmon themselves, and making use of crude appliances, their catches have nevertheless been large, and yet have seemed to produce no appreciable effect upon the abundance of the supply. Thus the advent of the whites found the fishery stock intact, so far as can be told. The Indians have greatly diminished; of the remnants many have been changed by civilization into commercial fishermen, employing for that purpose the old-time reef nets, gill nets, seines, and hooks and lines, to all of which reference has just been made. Those which still hold to the primitive methods of fishing for their own needs, chiefly in the upper parts of rivers, are comparatively few. Their apparatus consists of spears, dip nets, and weirs, the last being a crude form of trap, which, though not extensively employed, can be so placed as practically to bar the entrance to important spawning-grounds. The spear has already been discussed; the dip net occupies a relatively inconspicuous position from the standpoint of its catch.

While under the original conditions the use of these several methods to the fullest extent required by the Indians may have caused no harm, with the heavy market fishery now in progress it may be necessary to impose some limitations. The steady drain near the mouths of the principal rivers makes it important that those salmon which reach the upper waters should be interfered with as little as possible. The use of the weir at least should be entirely prohibited, as has been done in British Columbia. It is important to note in this connection that the Indians have been guaranteed certain treaty rights which should be respected. They are fast yielding to civilization; their power for harm is already infinitesimal when compared with the whites, and seems likely soon to cease altogether. In Washington no restrictions are put upon the Indians in fishing to supply their own needs. In British Columbia they are permitted to take salmon for their own use by their customary methods, aside from the weirs, at any time and anywhere except on the spawning-grounds. In respect to the last provision many violations are reported and require attention. In all commercial fishing they are subject to the same regulations as the whites.

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* By the act of March 13, 1899, it is made unlawful to fish for salmon by any means except angling above tide water in the Nooksack, Skagit (up to the town of Hamilton), Stillaguamish, Snohomish, White, Nesqually, and Skokomish rivers. The State fish commissioner may also close to fishing any stream or river of Washington emptying into Puget Sound whenever he shall consider that the protection of its food-fishes require it.

While suitable regulations as to the character and manner of using the different kinds of apparatus might be expected to provide for the escape of a sufficient number of fish to cover all the requirements for spawning, yet in practice, and this holds true especially with the salmon, it has been found essential to supplement the restrictions already referred to by a total cessation of fishing during more or less of the period when the fish are running. The laws of Canada seem quite ample in this respect, but in Washington the matter has not been fairly treated. Although the need of such regulations may not appear important while the supply of salmon continues large, yet we can not question the benefits already derived from the measures of this kind enforced on the Fraser River. and urge their early adoption elsewhere as one of the surest means of maintaining the supply of the choicer species.

The most suitable periods for the close times and their proper duration give rise in this region to questions of some perplexity. Had we to deal with only a single species, or at the most with two differing so much in size and season as the quinnat and the sockeye, there would be little trouble in reaching a satisfactory arrangement, but with six species appearing at successively later periods and yet overlapping, sometimes quite markedly, in their runs, many difficulties are presented. The time most commonly selected for the salmon is toward the close of the run, when it has the additional advantage of preventing their capture and sale when they are in the least acceptable condition for food. Doubt has often been expressed as to whether this protection of the later-running fish is of any benefit to the earlier runs of succeeding years, on the supposition that salmon run at the same time and to precisely the same places as their progenitors, but until these questions have been more positively decided there seems to be no reason why the customary practice should not continue.

In British Columbia the subject is very much simplified by the facts that the commercial fishery is directed mainly toward the quinnat and sockeye and is restricted to a single method. The larger mesh of the quinnat drift nets can be used through the sockeye season without interfering with the latter species, and the reverse is true with regard to the smaller mesh adapted to the sockeye. Thus a close season may be arranged for one species while fishing for the other still goes on. According to the existing Canadian regulations the smaller-meshed nets must be withheld from the water from August 25 until September 25 of each year, when the sockeye have ceased running and only later species can be taken. From October 31, again, until July 1 of the following year their employment is entirely prohibited. Between August 25 and September 25 protection is afforded the latter half of the humpback run and the early part of the silver salmon run, while the dog salmon, being still plentiful after October 31, enjoys the benefit of the long close season, which continues through the winter. The open season for the large-meshed nets is from March 1 to September 15, and thus only the very beginning and the closing part of the quinnat runs are free of any interference from the nets.

In Washington the variety of apparatus makes the adjustment of close times quite difficult to decide. The trap net is omnivorous, taking whatever comes its way, but being generally utilized only for the sockeye, it has commonly had little relation to other species. The drag and purse seines, while better adapted for some species than for others, can be considered as selective only as their use may be directed toward the schools of one variety or another, and are mainly employed in the late summer and the fall. When the sockeye run is small the trap nets may be continued in place for the purpose of taking other species, and the rapid increase in the fishery will doubtless tend to their employment during a greater part of the year than has heretofore been customary.

Just how a close-time measure should be framed so as to benefit all the species under these complex conditions is a matter requiring further and careful study, especially as the main part of the fishery is so essentially a salt-water one. It is to be assumed that such a scheme is practicable and it is further to be hoped that steps may soon be taken toward its realization, but in the meantime the interests of the sockeye and quinnat should not be allowed to suffer. Close seasons could readily be arranged for each of those species in both the salt and fresh waters and they should at once be instituted. Washington has no close-time regulations whatsoever applicable to the salt water. On the rivers fishing is stopped during April and again from October 1 to November 15.* Only the quinnat could be benefited by this first close season, and the silver and dog salmon by the second. The latter part of both the sockeye and quinnat runs should certainly be protected by regulations fully as comprehensive as those in force in British Columbia, and it would be better if the close time for the quinnat should begin at even an earlier date than there.

Some of the difficulties presented by the annual close times may be overcome by the introduction of shorter periods of rest at intervals during the salmon season. This measure is not suggested as a substitute for the other, but as supplemental to it and of great additional benefit. It is provided for in British Columbia, where all net fishing is stopped by law during the thirty-six hours from 6 a. m. on Saturday to 6 p. m. on Sunday of every week. The special advantages of this weekly close time are several. It assures the ascent to their spawning-grounds of fish of the same species at different periods during the entire season, thus meeting the objection raised against the fall close time as protective only of the later runs. There is likely to be considerable variation in the duration of the season, which, in the case of the sockeye at least, may end before the date appointed for the fall close time. The weekly periods make up for this discrepancy and also afford fishermen a regular period of rest from their work, which in the case of those who are in the regular employ of large establishments is not unwelcome, especially if it falls mainly upon Sunday, as is customary.

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* By act of 1899 the latter close season extends from October 15 to November 15.

The extension of such a regulation to the waters of the State of Washington, so far as this can be done advisedly, is strongly to be recommended. The measure is most important in respect to the sockeye, and its utility is most evident on the rivers, where the salmon are pressing rapidly toward their spawning-grounds. In even the salt waters the sockeye move so quickly along their defined course that a weekly close time in their interest should be favorably regarded. The inner salt waters are to them apparently almost a continuation of the rivers in which their spawning-grounds occur. A period of thirty-six hours may be too short to permit the fish some distance out in the sea to pass the upper limit of the nets, and it may, upon further inquiry, be found advisable to begin the close time somewhat earlier in the salt water, but even should it for the present be made uniform throughout, it is scarcely to be doubted that the relative number of fish that reach the spawning-grounds would be increased. There is some question as to the benefits to be gained by other species through a measure of this kind, as most of them at least remain in the inner sea for a longer time than the sockeye, and some for quite a period, as in the case of the quinnat. They should undoubtedly be so protected in the rivers and about the mouths of the rivers.

The close-time question with reference to the steelhead requires to be considered apart from the other species, in consequence of the fact that its movements and spawning take place at quite a different season. The growing demand for the species and the opportunities for its capture in the fresh water during a long period make it very important that its welfare be not neglected from this standpoint.

In a new region, where existing conditions have favored so bounteous a supply of salmon, it is quite unnecessary to consider for the present whether their ascent is anywhere impeded by natural obstructions. The introduction of fishways or the clearing away of barriers might in some localities open up new spawning-grounds, and such measures may in time be called for, but the gain would scarcely be realized while the salmon remain as abundant as they are, and the expenditure required would be considerable.

Of artificial impediments, aside from the nets, there appear to be few in any of the fresh waters, and, in fact, no complaints of such have reached the writer. The building of dams in the pathway of the fish should be prevented as far as possible, and if any are allowed they should have openings of ample size to permit the passage of the immense schools which ascend these streams. On many of the Atlantic rivers much harm has been done the salmon by the rubbish from sawmills passing into the water, a practice which has been followed here to some extent. The prohibition against it in British Columbia is said to be enforced, but in Washington and especially on the Skagit River, if the reports be true, the sawdust and other refuse have been dumped into the water so extensively in places as to threaten serious injury. As this material can readily be disposed of on land by burning or otherwise, there is no excuse for continuing the custom.

There seem at present to be no sources of general pollution, such as the drainage from large communities, which need to be considered from a fishery standpoint, but they are likely to appear with the increase of population. The same is true regarding obnoxious waste products from extensive factories except in one particular, resulting from the fisheries themselves. This exception is furnished by the salmon canneries in consequence of the immense amount of offal which they produce and which is customarily thrown into the water. In Washington the canneries are all located on salt water and their offal gives no trouble, as it disappears quickly and entirely. It is different on the Fraser River, where the many canneries are mostly collected near its mouth.

Several measures looking toward the disposition of waste materials without detriment to any interest have been adopted by the Canadian government, but none has long been enforced, the remedies being ineffectual in some cases and impracticable in others. Offal carried out to the gulf and dumped off the mouths of the river is liable to be washed ashore, while its manufacture into oil and fertilizer on a large scale has heretofore proved unsuccessful. The old practice of allowing it to fall into the water of the river in a fresh condition as fast as it is produced has, as a whole, given the best results, and is the one quite universally pursued, and there is no specific evidence that it has been detrimental to the welfare of the salmon; nor except in a few localities has there been complaint that it was injurious to the health of the community. When thrown into the current fresh the offal seems to be quickly dissipated, and it produces a nuisance only when placed in quiet, shallow water or in eddies, which tend to retain it along the shores or to carry it into the adjacent sloughs. If held long enough for decomposition to set in, it tends to float at the surface. Pending the discovery of some better way it seems advisable to sanction the present practice under due restrictions, the fishery officers being empowered to prevent its deposition wherever it would be prejudicial.

The fishermen of this region are quite alive to the benefits of fish-culture, and many of them, in fact, have so strong a faith in its efficacy as to lead them to magnify its possibilities and to conclude that through its agency the necessity for any regulations may be dispensed with. They argue that if the eggs be secured in sufficient quantities and the proportion of survivals be as great as claimed by some fish-culturists, why should not the supply of fish be capable of maintenance and even of unlimited increase by this means alone? There is no evidence, however, that would warrant us in anticipating so large a measure of success either here or elsewhere, and the time of unrestricted fishing is undoubtedly as far distant now as ever.

The artificial propagation of the sockeye was started on the Fraser River in 1884, and since 1887 the number of fry and advanced eggs planted yearly has ranged from 2,400,000 to something over 6,000,000. Its primary object was to equalize the annual runs of that species, to make them larger during the off years. The abundance of fish during the past few seasons has been very commonly ascribed to this cause, the quantity having apparently become greater in all years. While it is to be hoped that there is some foundation for this explanation of the increase, it is well to bear in mind that the annual output of fry, especially after allowing for the inevitable mortality among them, has been much smaller than the annual catch of adult fish, and scarcely sufficient to make itself felt to anything like the extent noted within so short a period.

On the Skagit River fish-culture began in 1896–97 with an output of 5,500,000 sockeye fry; in 1898, 6,000,000 were planted, while the number of eggs collected in the fall of 1898 was 7,500,000. The opportunities for collecting the eggs on this stream are exceptionally good, but it is still too early to expect results. The quinnat offers a much more interesting field for experimentation than the sockeye in the direction of improving the color and quality of its flesh by the introduction of fry from the Columbia River—a project suggested some years ago, but never carried into effect. While the success of such a measure could only be determined by actual trial, it seems to be worth the effort, and the transplanting presents no difficulties that could not readily be overcome. An increase in the abundance of the species is also called for.

A great waste of salmon occurs in connection both with canning operations and with the fishery, which may be expected to continue as long as fish are plentiful. Lacking an incentive to economize in the preparation of the catch, little pains are taken by the cannery operatives to cut closely in removing the heads and fins, and much edible meat is thus lost. The exercise of greater care would add to the expense of canning without material gain under existing circumstances, but in time much of these rejected parts will come to have a value. The more serious waste, however, results from overfishing in years of great plenty, as in the case of the sockeye on the Fraser River, where in some years the catch is much larger than can be handled. Immense quantities are thrown away, prices fall, and the independent fishermen lose heavily, while the canners and dealers who control the market can so regulate the catch by their own boats as to keep it within the proper bounds. The impulse to increase the amount of fishing in the good years is quite natural, but it would seem as though the number of nets allowed might be adjusted to suit the conditions of each season, were the requisite discretionary powers conferred upon some local authority. The matter can not be remedied through the medium of an inflexible law, and decisive action may need to be taken after the season has fairly opened.

As the sockeye catch has seldom, if ever, been equal to the demand in the waters of Washington, it is improbable that there has ever been a serious, if any, waste of this species south of the boundary. While the traps may secure exceedingly large catches at times, the methods of keeping the fish alive have prevented loss, except perhaps in some cases where they have had to be transported a considerable distance by scows. The discarding of the humpbacks taken in the traps with the sockeye after removal from the water causes much destruction of that form, which seems at present to be unavoidable.

DESCRIPTIONS OF NEW GENERA AND SPECIES OF FISHES FROM PUERTO RICO.

By Barton Warren Evermann and Millard Caleb Marsh.

In December, 1898, the Commissioner of Fish and Fisheries sent the Fish Commission steamer *Fish Hawk* to Puerto Rico for the purpose of making investigations regarding the aquatic life of that island. The investigations extended over a period of two months. The island was circumnavigated and work was done at practically all places where safe anchorages are found, and several trips were made by members of the scientific staff to points in the interior of the island, where the fresh-water streams were examined. The itinerary of the vessel when working about the island was, briefly, as follows:

Jan. 2 to 17, at and about San Juan.
Jan. 18, at Aguadilla.
Jan. 19 to 24, at and about Mayagüez.
Jan. 25, at Ensenada del Boqueron.
Jan. 26 and 27, about Puerto Real.
Jan. 28 and 29, in Guanica Bay.
Jan. 30 to Feb. 2, at Ponce.
Feb. 3 and 4, at Arroyo.
Feb. 5, at St. Thomas.
Feb. 6, running a line of dredgings between St. Thomas and Vieques Island.
Feb. 7, at Isabel Segunda, Vieques Island.
Feb. 8, dredging between Vieques and Culebra islands.
Feb. 9 to 12, about Culebra Island.
Feb. 13 to 15, about Hucares.
Feb. 16 to 18, about Fajardo.
Feb. 19, at St. Thomas, coaling.
Feb. 20 to 22, at San Juan.

Land trips to the fresh-water streams of the island were made by one or more members of the party as follows:

Jan. 8 to 10, to Caguas, where collecting was done in the Rio Grande and the Rio de Caguita.
Jan. 12, to Bayamon, where the Bayamon River was examined.
Jan. 15 and 16, to Arecibo.
Jan. 22 and 23, from Mayagüez to Aguadilla.
Jan. 29, from Guanica, via Yauco, to Ponce.
Feb. 2 and 3, from Ponce, via Coamo, Aibonito, Cayey, and Guayama, to Arroyo.
Feb. 16, from Hucares, via Ceiba, to Fajardo.
Feb. 18 to 21, from Fajardo, via El Yunque Mountain, Rio Grande, and La Carolina, to San Juan.

Large collections of fishes, mollusks, crustaceans, and other aquatic animals were made. These are now being studied by specialists in the various groups and the results will be published in the detailed report upon the work of the expedition, which is now in preparation and which will soon be ready for publication.

Among the fishes obtained are 3 new genera and at least 20 new species, of which preliminary descriptions are given in the present paper. In the detailed report upon the investigations of the *Fish Hawk* in Puerto Rico will be found illustrations of most of these species.

1. **Lycodontis jordani** Evermann & Marsh, new species.

Head 7 in total length; depth about 14; eye 8 in head; snout 5; gape 2.2; interorbital a little less than snout. Teeth uniserial, strong, sharp, not close-set, all entire and without basal lobes; tail considerably longer than rest of body; gill-opening smaller than eye; snout rather pointed, lower jaw the shorter, the mouth capable of being completely closed. Dorsal fin high, much higher than anal; nasal tube long, about 3 in eye.

Color: Tawny ochraceous, paler below; upper jaw gray; iris blue; longitudinal brown stripes on side of head in front of gill-opening; head and body covered with numerous small, round, white spots, those on head smallest; a series of larger ones along upper part of side, and 1 or 2 irregular series of large ones on side of belly; between these on the middle of side the spots are smaller; dorsal with an irregular series of small white spots along the base, and another series of about 16 much larger, more quadrate spots of same color along edge of fin, some of the spots cutting the border, which is black; anal similarly spotted and with black border. In alcohol the general color is grayish-black, yellowish below, the tawny ochraceous or yellow becoming darker, almost black, and the white spots on body becoming yellowish.

This species seems to be related to *L. obscuratus* (Poey), but differs markedly from it in color. Only the type (No. 49358, U. S. N. M.), a specimen about 15 inches long, was obtained. This was collected at Mayagüez, January 20, 1899.

Named for Dr. David Starr Jordan.

2. **Stolephorus gilberti** Evermann & Marsh, new species.

Head 3.25; depth 3.4; eye 4; snout 6; maxillary 1.7; mandible 1.7; interorbital 4.9; D. 15; A. 23; pectoral 2.1; ventral 3.5; caudal 1.3; scales 42–9.

Body comparatively deep and strongly compressed, the belly trenchant, without serrations; snout thick, much projecting; maxillary reaching nearly to root of mandible, scarcely serrate; eye moderate; tip of lower jaw reaching vertical from front of eye; distance from lower posterior angle of cheek to vertical from posterior margin of opercle much less than from same point to eye; dorsal inserted far in advance of anal, just behind insertion of ventrals, midway between anterior edge of eye and base of caudal.

Color in spirits: Back light olivaceous with dark punctulations; rest of body below a line from shoulder to upper base of caudal silvery; faint traces of golden behind eye; no lateral band.

This species is very close to *Stolephorus garmani*, differing chiefly in the much smaller eye, the more uniform color of the back, the somewhat more sharply compressed belly, and the more nearly entire maxillary. One specimen, the type (No. 49359, U. S. N. M.), 4.5 inches long, collected at Palo Seco, near San Juan, January 13, 1899, associated with *S. productus*, with which species both *S. gilberti* and *S. garmani* Evermann & Marsh are allied.

Named for Dr. Charles Henry Gilbert, of Stanford University.

3. **Stolephorus garmani** Evermann & Marsh, new species.

Head 3.2; depth 3.3; eye 3.5; snout 5.5; maxillary 1.7; mandible 1.7; interorbital 5; D. 14; A. 23; pectoral 2; ventral 3.5; caudal 1.3; scales 42–9.

Body comparatively deep and strongly compressed; the belly not strongly trenchant, without serrulations; snout thick, much projecting; maxillary reaching nearly to root of mandible, very finely and weakly serrate; eye large; tip of lower jaw reaching vertical from front of eye; distance from lower posterior angle of cheek to vertical from posterior margin of opercle much less than from same point to eye; dorsal inserted far in advance of anal, just behind insertion of ventrals, midway between anterior edge of pupil and base of caudal.

Color in spirits: Back dark near the median line, below this somewhat reddish; rest of body below a line from shoulder to upper base of caudal silvery; some golden on snout and behind eye; no lateral band.

This species has a general resemblance to *Stolephorus productus*, but is unquestionably distinct from it; the anal is much shorter and inserted farther back, the body is deeper, the eye larger, and the snout longer. It is very close to *Stolephorus gilberti* Evermann & Marsh, differing chiefly in the larger eye, in the color of the back, and the somewhat less sharply compressed belly. One specimen, the type (No. 49360, U. S. N. M.), 4.5 inches long, collected at Puerto Real, January 27, 1899.

Named for Prof. Samuel Garman, of the Museum of Comparative Zoology.

4. **Prionodes baldwini** Evermann & Marsh, new species.

Head 2.5; depth 3.2; eye 4; snout 4.6; maxillary 2.4; mandible 2; interorbital 7; D. x, 12; A. iii, 7; pectoral 1.4; ventral 1.3; caudal 1.7; scales 4–42–12.

Body elongate, moderately compressed, not elevated, covered with ctenoid scales; dorsal and ventral outlines alike; head moderate, pointed, naked above and below; eye large, greater than length of snout, high in position; mouth terminal, slightly oblique, the maxillary reaching middle of eye or somewhat beyond; gillrakers short, 6 developed on lower limb; teeth small, conical, and sharp, on vomer and palatines and in several series in each jaw, with weak canines in front and a few canine-like teeth on middle of side of lower jaw; cheek with about 7 rows of scales; preopercle finely serrate; opercle ending in 3 sharp, flat spines, the middle one largest, a membranous pointed flap projecting beyond; fins all naked, the dorsal continuous, with a slight emargination, the spines slender and pungent, the first 4 or 5 graduated, the rest subequal, 3.2 in head, lower than the soft rays which are contained about 2.5 in head; anal fin short, the second spine longest and strongest, 3 in head, the soft part high, the fifth or sixth ray longest, reaching almost to front of anal, 2 in head; ventral with second ray produced, reaching vent; caudal truncate, or with middle rays very slightly shorter, making the margin slightly concave.

Color in life: Dorsal half of head and trunk and all of caudal peduncle scarlet, ventral portion pale blue, almost white; a yellow longitudinal band, nearly as wide as pupil, from preopercular margin straight across opercle and along body to lateral line under last dorsal rays; 4 quadrate or oblong black blotches just under this band, the first about under middle of spinous dorsal, second under last spines, third under first rays, fourth under last rays; from each of the first three of these blotches a square, well-defined yellow shade extends downward to belly or base of anal, a similar one from base of pectoral to ventral; 4 smaller black blotches at base of caudal, two others, somewhat larger than the last, just in front of them on caudal peduncle; a row of 9 black, round dots on each side at base of dorsal fin, the first one smallest, opposite membrane of first spine, the other 8 separated somewhat obscurely into pairs, the first pair under middle spines, second under last spines, third under first rays, fourth under last rays; 2 or 3 very small black dots on upper edge of caudal peduncle; 2 or 3 more in front of dorsal on median line, each accompanied by a similar one on either side; in some specimens a few scattering ones on top of head behind eyes, sometimes regularly arranged; a few dark-brown spots behind eye; various dark markings on side of head, without very definite pattern, but usually 2 oblique stripes on cheek, a heavy black blotch on interopercle and 2 on the ramus of the mandible, which, with their fellows of the other side, make distinct cross-bars on lower side of head usually extending across maxillary; chin and lower part of opercle with dark spots; lateral line white, with a few broken spots, comparatively faint, just below it; iris red, with an inner ring of white surrounding the pupil; spinous dorsal pale, the edge of the membrane black, this color bordered below with faint yellow; soft dorsal pale, spotted throughout with light orange, with a marginal band of the same, outside of which is a very narrow pale-blue edge; ventral very pale-blue, the produced ray somewhat yellow; anal pale-blue with some light orange on last rays; pectoral and caudal uniform pale-reddish, unmarked.

In spirits all the red and yellow markings disappear, the dark persists, and additional markings are brought out, as follows: Along the anterior and upper part of trunk and crossing the lateral line are dark-brown vertical bars, diffuse and running together, or separated and broken into round or quadrate blotches; in the middle part of the course of the yellow longitudinal band appears a row of very small black points; spots on soft dorsal dusky; dark mottlings on caudal; upper and lower base of pectoral, and sometimes axil, dusky.

A beautiful and strongly marked species; 2 specimens dredged and 33 others, ranging in size from 0.55 to 2 inches, caught in the tangle, off Culebra and Vieques islands, from coral bottom, in depths of 15 and 16 fathoms; the type (No. 49361, U S. N. M.), 2 inches long, taken in the tangle at *Fish Hawk* station 6093, off Culebra Island, 5.25 miles southwest of Culebritas light-house, February 8, 1899, in 15 fathoms.

This species is named for Mr. Albertus H. Baldwin, the artist of the expedition, in recognition of his excellent drawings and paintings of American fishes.

5. **Calamus kendalli** Evermann & Marsh, new species. *"Pluma."*

Head 3.1; depth 2.1; eye 3.5; snout 1.5; maxillary 2.4; interorbital 3.5; preorbital 2.1; D. XII, 12; A. III, 10; pectoral 1; ventral 1.8; caudal 1.3; scales 7–53–16.

Body deep, back strongly elevated, more so than in *C. bajonado*, but less than in *C. calamus* or *C. proridens*, the anterior profile a nearly regular curve, lacking the abrupt nuchal elevation of those species; eye large, larger than in *C. proridens;* 7 or 8 rows of scales on cheek; teeth about as in *C. proridens;* molars in 2 or more rows on sides, those of inner row much the largest, those in front becoming more numerous and merging into cardiform teeth, the most anterior of which, in each jaw, are somewhat enlarged; in front of upper jaw are 2 much enlarged antrorse canines, curved slightly upward; highest dorsal spine 2.7 in head, second anal spine 4.6.

Color in spirits: Silvery, sides with bluish longitudinal lines following the rows of scales, plainest above; a pale-blue line bordering the orbit below; some blue lines on preorbital, not evidently reticulated and not as numerous as in *C. proridens;* iris yellow; otherwise as in *C. proridens*, to which this species is very close.

Type No. 49362, U. S. N. M., 10.5 inches long, collected at Mayagüez, January 20, 1899; 2 others, each 8.5 inches long, from Mayagüez and Arroyo, are more slender (depth 2.3 and 2.45 in length), but not differing in any other character.

Named for Dr. William Converse Kendall, scientific assistant, U. S. Fish Commission.

6. **Doratonotus decoris** Evermann & Marsh, new species.

Head 2.6; depth 3.4; eye 4; snout 3.5; maxillary 4; interorbital 4.6; D. IX, 10; A. III, 9; pectoral 1.6; ventral 2.2; caudal 1.6; scales 1–26–6. Body moderately elongate, compressed throughout; the back a little elevated, the caudal peduncle deep and rather long; dorsal and ventral outlines nearly alike, the dorsal somewhat more strongly arched; anterior profile not trenchant, almost straight from snout to front of dorsal, very slightly convex in front of dorsal and very slightly concave between eye and tip of snout; head pointed, interorbital space broad and flat; eye large, high in position, middle of pupil nearer tip of snout than end of opercle; snout long, somewhat longer than diameter of eye, moderately produced, the lips broad in front, characteristically labroid; mouth not large, the maxillary not reaching front of orbit, the jaws equal, armed with strong sharp teeth, about 4 canines in front of upper jaw, 2 in front of lower; teeth on sides of jaws also canine-like, smaller than those in front, but not distinctly different from them; a few smaller teeth behind the main row of large ones; vomer and palatines toothless; soft dorsal and anal each with a basal sheath of about two rows of large scales, that of dorsal extending over half the fin or more, that of anal lower, the fins otherwise naked; dorsal fin continuous, with a shallow notch, the spines slender and pungent, the second longer than the first, the following ones graduated to the fifth, which is shortest, thence increasing in length to the ninth, which is longest, 2.3 in head; soft dorsal with its middle rays highest, 2.2 in head; anal with three slender, sharp, graduated spines, the third longest, 2.2 in head; the soft part similar to soft dorsal, longest rays 2.3 in head; pectoral large, symmetrical, of 11 rays, the middle ones longest, reaching past tip of ventral nearly to vent; ventral moderate, pointed, reaching half way to vent; caudal rounded; scales large, cycloid, the lateral line on second row below the dorsal, interrupted near the end of dorsal and beginning again on the row below, on caudal peduncle.

Color in life: Body chiefly green, darker green on back, lighter below; lower parts of head and breast light yellow; a broad white bar from eye obliquely across cheek and opercle, bordered above by an undulating maroon line and below by a similar, but fainter line; a brown bar from eye to snout; 4 dusky spots near base of dorsal extending as fainter shades downward and slightly forward to or beyond lateral line, 1 from in front of dorsal, 2 under spinous dorsal, and 1 under soft rays; short pale-blue bars or spots on breast and about pectoral; iris blue, a pinkish border surrounding pupil; dorsal greenish, the soft part with yellow shade, a pale-blue edging to the whole fin, a maroon border to the green color posteriorly just inside the pale-blue edge, a small dark spot on membrane between seventh and eighth rays and a blue spot on membrane of first spine; anal colored like soft dorsal, the maroon border extending from first spine to last ray inside the pale edging, the dark spot between sixth and seventh rays; ventral green near base, pale blue outwardly, the green color bordered by maroon spots; pectoral plain, pale green; caudal very pale transparent blue, a wedge-shaped maroon spot on the 2 upper rays near tip and a corresponding one on the 2 lower rays, the base of the wedge on outer ray; base of caudal with a pale undulate vertical bar bordered in front by a black line. In spirits, pale green, the maroon markings faintly persistent, becoming dusky.

One specimen, the type (No. 49363, U. S. N. M.) 1.45 inches long, taken in the seine at Ponce, January 30, 1899.

Decoris, beautiful.

7. Sicydium caguitæ Evermann & Marsh, new species.

Head 4.4; depth 4.8; eye 5.75; snout 2.5; maxillary 2; mandible 2.75; interorbital width 3; preorbital 3.5; D. VI-I, 10; A. I, 9; scales 83-25; longest dorsal spine 1.5 in head, longest ray 2; longest anal spine 2 in head, longest ray 2; pectoral 1.1; ventral disc 1.75; caudal 1.

Body rather stout, heavy forward; head large, broad; mouth large, its width 1.5 in head; lips very thick; maxillary not greatly produced; teeth simple, flexible; a median cleft in upper lip; pectoral somewhat shorter than head; dorsal spines without filaments, the longest about 1.5 in depth of body; space between dorsals about equal to orbit; soft rays of dorsal and anal scarcely reaching base of caudal; ventrals united, forming a cup-shaped disc, only about two-fifths posterior edge free from belly; caudal rounded. Scales very small, ctenoid, densely covering entire body except a broad strip on belly; posterior portion of nape with very fine scales; entire head naked.

Color: Dark brown or olivaceous on head, sides, and back; under parts pale; fins all pale, the anal with a narrow darkish margin; caudal somewhat dark; no dark vertical bars on body and none at base of pectoral; no H-shaped figure at base of caudal.

This species is close to *S. plumieri*, from which it differs chiefly in the color, the more complete squamation, the shorter pectoral, and the non-filamentous character of the dorsal spines.

A single specimen (type No. 49364, U. S. N. M.), 3.63 inches long, obtained in the Rio de Caguita at Caguas, January 9, 1899.

8. Gobius bayamonensis Evermann & Marsh, new species.

Head 4.8; depth 6.4; eye 5; snout 3.2; maxillary 1.8; mandible 1.9; interorbital 7.6; preorbital 4.6; scales 71-19, about 29 before dorsal; D. IV-14, the longest spine about 0.7 in head, the longest ray 1.5; A. 15, the longest ray 1.5; pectoral 1.1; ventrals 1.1; caudal very long and pointed. Body very long and slender; head long; caudal peduncle long; mouth very large, oblique; maxillary long, reaching past posterior border of orbit.

Color as in *G. oceanicus*, which this species closely resembles. The smaller (71 instead of 63 to 65), almost cycloid scales, the longer head, larger mouth, longer maxillary, and the longer and more slender body are differences which we can not reconcile with the descriptions of that species or with the numerous specimens of it which we have from Puerto Rico.

This description is based on a single specimen 9 inches in length, No. 49365, U. S. N. M., bought in the San Juan market, January 14. It probably came from near the mouth of Bayamon River at Palo Seco, for which stream the species is named.

9. Bollmannia boqueronensis Evermann & Marsh, new species.

Head 4; depth 5.5; eye 3.5; snout 4.4; maxillary 2.2; mandible 2.5; interorbital width 3 in eye; preorbital 6; scales 27–8; D. VII–13, the longest spine 1.5 in head, the longest ray 1.2; A. 12, the longest ray 1.25 in head; pectoral 1; ventrals 1.1; caudal 0.4.

Body long, slender, tapering; head short; snout blunt; mouth large, oblique; jaws subequal, maxillary reaching posterior border of pupil; isthmus narrow, the gill-openings reaching forward to below preopercle; eyes large, high, close together, the interorbital very narrow and without median keel; no fleshy process on inner edge of shoulder girdle; teeth on jaws in narrow bands, those of outer series somewhat enlarged; opercle short, about 3 in head. Fins moderate; origin of spinous dorsal slightly behind base of pectoral, its spines 7 in number, not filamentous; interspace between dorsals less than diameter of eye; soft rays of dorsal and anal reaching, when depressed, beyond base of caudal; caudal long and pointed, as in *Gobius oceanicus;* pectoral pointed, reaching beyond origin of anal; ventral disc moderate, free from belly, the longest rays barely reaching origin of anal. Scales very large, weakly ctenoid; nape, cheeks, and breast scaled, the scales somewhat smaller than on body, about 9 scales before the dorsal.

Color: Pale olivaceous or straw color, back and upper part of head with profuse fine dark punctulations; under parts pale, breast somewhat dusky; dorsal fins barred with white and dark, a large jet-black ocellus on posterior part of spinous dorsal; other fins pale, the ventral disc somewhat dusky in front. Length, 2.75 inches.

Known only from the type and 4 cotypes dredged by the *Fish Hawk* at station 6074, off Puerto Real, in 8.5 fathoms, January 25, 1899. Type No 49366, U. S. N. M.

This interesting little fish belongs to a genus hitherto known only from the Pacific, from which 4 species have been described, the type species (*B. chlamydes* Jordan) from the coast of Colombia, and three others (*B. ocellata* Gilbert, *B. macropoma* Gilbert, and *B. stigmatura* Gilbert) from the Gulf of California.

Named from Ensenada del Boqueron, near which the type was obtained.

10. Microgobius meeki Evermann & Marsh, new species.

Head 3.75; depth 6; eye 3.5; snout 5.5; interorbital 7; preorbital 7; maxillary 2; mandible 1.5; scales 55–12; D. VII–17; A. 16.

Body slender, greatly compressed, tapering regularly from pectorals to caudal; head moderately heavy, interorbital space very narrow; eye large, high; mouth large, oblique; maxillary reaching posterior border of orbit; lower jaw projecting; teeth in bands in each jaw, the outer series greatly enlarged and strongly recurved, those of lower jaw largest; isthmus rather narrow, the gill-openings continuing forward.

Body densely scaled, the scales strongly ctenoid, those anteriorly somewhat reduced; nape, breast, and entire head naked. Origin of spinous dorsal from snout 3.5 in length; dorsals very close together; spines of first dorsal filamentous, exceeding head in length; soft dorsal and anal long, their bases about equal, about 2.5 in body, their last rays reaching past base of caudal when depressed; caudal pointed, its longest rays about equal to head; pectoral about equal to head, reaching origin of anal; ventrals united, almost reaching origin of anal.

Color: Light-olivaceous, dusted over uniformly with fine dark punctulations; a large dark shoulder-spot between the base of pectoral and origin of spinous dorsal; a few indistinct dark areas on side of head; lower jaw dark at tip; an obscure dark blotch at base of caudal; fins all rather pale except ventrals, which are dark, perhaps bluish in life; caudal somewhat dusky; anal dark-edged. Length 1.5 inches.

This species seems related to *M. eulepis* Eigenmann & Eigenmann, described from Fortress Monroe, Va., but differs in the smaller and strongly ctenoid scales, greatly compressed body, and in the coloration.

Described from a single specimen, 1.5 inches in length (No. 49367, U. S. N. M.), collected at *Fish Hawk* station 6087, in 15.25 fathoms, between Culebra and Vieques islands.

Named for Dr. S. E. Meek, assistant curator of zoology, Field Columbian Museum.

GILLIAS Evermann & Marsh, new genus.

Gillias Evermann & Marsh, new genus of *Blenniidæ* (*jordani*).

Body short and stout, tapering rapidly from the short, broad head to the short, compressed caudal peduncle; scales large, rough-ctenoid; lateral line complete, or nearly so, broken under last spines of middle dorsal; a broad, double-pointed tentacle above eye; dorsal fin divided into 3 parts, the first of 3 short spines, the second of 11 longer spines, and the third of 7 rays.

This genus is closely related to *Enneanectes* Jordan & Evermann, from which it differs in the presence of the orbital tentacle, the more complete development of the lateral line, and the larger scales

Named for Dr. Theodore Gill.

11. Gillias jordani Evermann & Marsh, new species.

Head 3.5; depth 4.3; eye 2.5; snout 3.5; maxillary 2.4; mandible 1.9; scales 2–30–7; D. III–XII–7; A. II, 15; longest dorsal spine 1.8 in head, longest ray 1.6; longest anal ray 2.3; pectoral 0.8; ventral 1.3; caudal 1.3.

Body short and stout, tapering rapidly to the short, compressed caudal peduncle; head short; snout short, blunt, concave in front of eyes; mouth small, slightly oblique, jaws equal; eye large, high up, interorbital width very narrow; a broad bifid orbital tentacle, none on nape. Scales very large and rough-ctenoid; opercles and entire head rough; lateral line nearly complete, beginning immediately above base of pectoral at upper end of gill-opening and extending parallel with back to posterior part of middle dorsal fin (or for 12 scales) where there is a break, the line dropping down 3 scales, then continuing with one or two interruptions to base of caudal; belly and breast scaled; dorsals 3, the first of 3 short, flexible spines, close to the second, which has 12 longer, rather stiffer, spines, separated from the third by a space one-third diameter of eye; anal long and low, the membranes deeply notched between the rays; pectoral of 15 rays, broad and short, reaching posterior end of second dorsal; ventral 2, slender.

Color in alcohol: Brown, body crossed by 4 broad blackish bars, one at the origin of second dorsal, one under last spines of same fin, the third between second and third dorsals, and the fourth under third dorsal; an inky-black bar across caudal peduncle at base of caudal fin; head and under parts rusty; fins all barred with light and dark; caudal with a narrow light bar at base, then a black one, then a broader white one, followed by a much broader dark bar containing some white areas, the fin finally tipped with white.

Two specimens of this well-marked and interesting species were obtained, the type, 1.5 inches long (No. 49368, U. S. N. M.), taken on the Cardona Light-House Reef, at Ponce, February 1, 1899, and another specimen of about the same size taken at the same place the preceding day.

Named for Dr. David Starr Jordan.

12. Malacoctenus culebræ Evermann & Marsh, new species.

Head 3.35; depth 5; eye 4.2; snout 4.5; maxillary 2.2; mandible 1.8; interorbital 6.5; scales 2–35–11; D. XXI, 8; A. II, 18; pectoral 1.3; ventral 1.3; caudal 1.4.

Body slender, compressed; head rather long, pointed, upper profile convex; mouth large, the maxillary nearly reaching posterior border of orbit; lips thick, jaws equal; teeth very small, conical, a single row in each jaw; a single nasal, ocular, and nuchal filament; dorsal fin moderately high, originating above the origin of lateral line, a shallow notch in front of last two dorsal spines, the membrane free from caudal; anal origin under about tenth dorsal spine; caudal somewhat pointed; pectoral large, reaching anal; ventrals moderate, not reaching anus, of two rays, no spine evident; lateral line distinct throughout, running high anteriorly, where it is slightly curved, turning abruptly downward over the origin of anal, thence median to base of caudal.

Color in spirits: Body everywhere mottled with dark brown, in somewhat regularly arranged blotches, a series of about nine of these at the base of dorsal, barely extending upon the fin; a similar series of much smaller ones at base of anal, not evident on all specimens; below the series at base of dorsal are two other series of the same blotches less deep in color and not so well defined, extending the length of body and sometimes forming, with the upper series, more or less broken vertical bars; between the blotches a lighter shade of brown is interwoven with pale streaks of ground color; head nearly pale below, save some dark on chin and isthmus; two wide streaks from eye across cheek; opercle dark brown; top of head with the color of body; lips with brown and pale stripes; posterior half of maxillary pale; dorsal rather dark; caudal uniform gray or faintly barred; anal similar to dorsal in color; the rays with pale tips forming a white edge; pectoral like caudal; ventrals pale.

A rather plainly marked species of different aspect from other Puerto Rican species of *Malacoctenus*, but not differing widely in any important character. It seems most closely related to *M. lugubris*. Three specimens of about the same size; the type, No. 49369, U. S. N. M., 1.38 inches in length, from the reefs outside the harbor of Culebra, February 9, 1899.

13. **Malacoctenus moorei** Evermann & Marsh, new species.

Head 3.6; depth 3.7; eye 3.5; snout 3.4; maxillary 4.5; mandible 4.5; interorbital 4; scales 3–45–5; D. XXII, 11; A. II, 20; pectoral 1 in head; ventral 1.2; caudal 1.2; longest dorsal spine 1.5; ray 1.2; longest anal ray 1.5.

Body short, rather stout, compressed; head short, snout short, but pointed; mouth rather small, little oblique, the gape scarcely reaching orbit; teeth in each jaw in a single series; gill-membranes broadly united across the isthmus; eye small, interorbital space wide; dorsal outline rising abruptly to above eye, thence gently curved to origin of dorsal fin, and from there nearly straight to base of caudal fin; ventral outline regularly convex.

Color in alcohol: Light olivaceous, the body crossed by about 9 or 10 dark broad vertical bars, which extend upon dorsal fin, these usually broadest above, the pale interspaces therefore broadest on lower half of body; the fourth from last is a narrow dark line, the one following it is a double spot, the next narrow and indistinct, the last, at base of caudal, more distinct, followed by 3 small irregular white spots; top of head brown; side of head with fine punctulations; a dark line running forward from eye, a dark spot below eye, 2 or 3 dark blotches on anterior edge of opercle; under surface of head crossed by 3 or 4 irregular, indistinct dark lines; caudal and anal with fine dusky punctulations; pectoral and ventrals pale.

This species is close to *M. gilli*, from which it may be distinguished by the larger dorsal and anal fins, the greater depth, wider interorbital, and the coloration.

Known only from one specimen, 1.4 inches long, type No. 49370, U. S. N. M., collected at Culebra Island, February 11, 1899.

Named for Dr. H. F. Moore, naturalist on the U. S. Fish Commission steamer *Albatross*.

14. **Malacoctenus puertoricensis** Evermann & Marsh, new species.

Head 3.4; depth 3.4; eye 4; snout 3.5; maxillary 3.4; mandible 2.6; interorbital 7; preorbital 8; scales 4–44–8. D. XX, 10; A. II, 19; P. 14; V. 2; C. 13.

Body short, stout, compressed; head rather long, snout long and pointed; mouth small, little oblique, the maxillary scarcely reaching front of orbit; teeth in a single row in each jaw; gill-membranes broadly united, free from the isthmus; eyes high up, interorbital narrow; caudal peduncle short, compressed, its least depth about 3 in head. Fins rather large; origin of dorsal over upper end of gill-opening, first spine slightly shorter than second, which is somewhat longer than the third, whose length is about 2.2 in head; no notch behind third and fourth spines, all the spines from third to fifteenth being about equal in length, the sixteenth and seventeenth being somewhat shorter, the remaining three progressively longer; soft dorsal higher, its longest ray about 1.7 in head; longest anal ray 1.7; pectoral broad, 1.25 in head, reaching anal; ventral barely reaching origin of anal; a pair of slender ocular cirri, a small supraocular one, a short, slender, nasal cirrus and a few very slender ones at the nape; scales large, not crowded anteriorly; lateral line well arched above the pectoral.

Color in alcohol: Brown, much spotted and vermiculated with darker; top of head brown, sides and under parts pale, crossed by about 5 broad, irregular brown bars; side of body with about 5 or 6 broad, dark crossbars, broader than the paler interspaces, broadest and darkest above and extending upon dorsal fin; under parts of body paler, more speckled; spinous dorsal with numerous small brown specks, a large black ocellus on base of 3 anterior spines, and a larger one on base of last 4 dorsal spines, being chiefly on body; soft dorsal, caudal, and anal each crossed by several series of small brown spots; pectoral and ventrals pale, the pectoral with a few brown spots at base.

The above description from the type, a female, 2.5 inches long, No. 49371, U. S. N. M., obtained at Hucares, February 14. Three female cotypes gotten at Fajardo, February 17, and one at Culebra, February 9, agree closely with the type; 2 of these, however, show faint traces of narrow horizontal lines along lower part of side.

A male, 2.5 inches long, from Culebra, February 11, taken as one of the cotypes, may be described as follows: Head 3.5; depth 3.7; eye 3.8; snout 3.2; maxillary 3.1; mandible 2.4; interorbital 7; preorbital 6.2; scales 3–45–9; D. XX, 10; A. II, 19; P. 14; V. 2; C. 13; longest dorsal spine 2 in head, longest ray 1.4; longest anal ray 1.5; pectoral 1; ventral 1.1; caudal 1.1. Color in alcohol, tolerably uniform brown; crossbars on side very faint; longitudinal lines more evident than in the female; throat and under parts of head mottled with white and light brown; fins less speckled than in female, the soft dorsal and anal pale, almost without spots.

Another male, 2.25 inches long, from Culebra, February 11, agrees with the large specimen just described, except that the crossbars on body are more distinct.

This species most closely resembles *M. bimaculatus* Steindachner, from which it differs in the larger head, greater depth, smaller mouth, narrower interorbital, and in the color. The tips of the anal rays are not white, the soft dorsal is spotted like the caudal and anal, and there are no white spots on base of pectoral, as is said to be the case in *M. bimaculatus*.

The collection contains 7 specimens of this species, as indicated above.

AUCHENISTIUS Evermann & Marsh, new genus.

Auchenistius Evermann & Marsh, new genus of *Blenniidae* (*stahli*).

This genus has the form of *Auchenopterus* and suggests that genus strongly. It differs in the absence of a lateral line, in the much smaller scales, in the absence of a notch at the front of the dorsal fin, and in the union of the membrane of the anal fin with that of the caudal.

αὐχήν, nape; *ἱστίον*, sail or fin.

15. Auchenistius stahli Evermann & Marsh, new species.

Head 5; depth 6.5; eyes 4.8; snout 6; maxillary 2.8; scales about 58, about 12 in transverse series; D. XLI or XLII; A. II, 23 or 24; pectoral 2.5; ventral 2.2; caudal 1.3.

Body elongate, somewhat compressed, especially posteriorly, the dorsal and ventral outlines alike; head small, upper profile straight and descending; snout moderate, pointed; mouth large, the maxillary reaching to or beyond middle of eye; the jaws equal, heavy and projecting; teeth in lower jaw conical, short and strong, slightly recurved, in one row; teeth in upper jaw similar to those in lower, but a small patch of smaller teeth in front of jaw behind the main row; teeth on vomer; gill-membranes joined to the isthmus; nostrils with short tubes, a single flap above each eye and one on each side of nape; dorsal fin long, of spines only; last four spines somewhat longer than the preceding, forming a shallow notch, a feature lacking in the other examples; anal origin about midway between tip of snout and tip of caudal, the fin similar to dorsal in shape, but somewhat lower; membrane of dorsal and anal joined to caudal; caudal small, pointed; pectoral small, of 8 rays; ventral small, of 2 rays.

Color in spirits: Body everywhere with a very slight yellowish tinge, in some specimens a faded gray; one specimen has traces of 10 or 12 dark crossbars; fins all pale, in one case with the dorsal and anal dark-edged.

The type, 1.2 inches long, No. 49372, U. S. N. M., from Ponce, February 1, 1899; 13 cotypes, 8 from the coral and algæ on the reefs at mouth of Culebra harbor, February 11, and 5 from Puerto Real.

Named for Dr. A. Stahl, of Bayamon, Puerto Rico, who, under many difficulties put in his way by Spanish authorities, made considerable collections of natural-history objects of Puerto Rico.

16. Auchenopterus albicaudus Evermann & Marsh, new species.

Head 3.2; depth 4; eye 4; snout 4.1; maxillary 2.2; mandible 1.6; interorbital 5.3; D. XXX, 1; A. II, 17; pectoral 1.4; ventral 1.5; caudal 1.6; branchiostegals 6; scales 1–34–6.

Body rather short, compressed; dorsal outline not elevated; head moderate, not broad; snout short, pointed; mouth large, oblique, maxillary extending to below middle of eye; lips broad, prominent; a band of conical teeth on each jaw, those on side somewhat enlarged and recurved; a patch of teeth on vomer, none on palatines; gill-membranes broadly united, free from isthmus; eye large, high up; nasal, supraocular, and nuchal regions with fringed tuft-like cirri; a considerable notch between fourth and fifth dorsal spines, but not reaching base of membrane; longest anterior spine scarcely as long as those of the posterior portion; scales large, reduced anteriorly; lateral line anteriorly separated from the dorsal fin by only one scale; head naked.

Color: Uniform dark brown on head and body, no dark crossbars; dorsal brown, mottled with lighter, narrowly edged with white; a black spot upon anterior 3 or 4 spines and a large black ocellus upon posterior portion of fin between twenty-second and twenty-fourth spines; anal rather darker, with narrow white edge; caudal peduncle black, the fin abruptly white at base, the entire fin being clear white, entirely without specks; pectoral black at base, then barred with white and dark; ventral black at base, the outer two-thirds barred with black and white.

This species seems to be related to the Pacific Coast species, *Auchenopterus integripinnis*, which it closely resembles, but differs from that species in the larger scales, the deeper body, and the coloration.

One specimen, 1.5 inches long, from Arroyo, February 4, 1899. Type No. 49373, U. S. N. M.

Albus, white; *cauda*, tail.

17. Auchenopterus rubescens Evermann & Marsh, new species.

Head 3.4; depth 5; eye 5; snout 3.8; maxillary 2.6; interorbital 5.8; scales 2–32–8; D. XXX, 1; A. II, 18; pectoral 1.5; ventral 2; caudal 1.4.

Body slender and compressed; head moderate, somewhat compressed above; snout pointed; mouth moderate, the jaws equal, the maxillary about reaching front of pupil; lips, especially the upper, prominent; teeth small, conical, and sharp, in both jaws, in a numerous patch on front of upper jaw, fewer on sides; in lower jaw less numerous in front, a long single row of somewhat stronger teeth on sides; eye not large; a small nasal flap, and a 3 or 4 branched tentacle over eye and one at nape; scales rather large and regularly arranged; dorsal fin with a notch behind third spine, and with one unbranched soft ray at its end, the membrane joined to caudal; origin of anal under eleventh dorsal spine; lateral line as usual in *Auchenopterus*.

Color in spirits: Everywhere a nearly uniform faded pink, save breast and lower side of head, which are paler; a small, inconspicuous dark round spot on dorsal fin, at twenty-third and twenty-fourth spines, a little nearer base than margin, and made up of very small black punctulations; indications of a yellow tinge on front of dorsal and base of anal in life; fins otherwise all pale.

The type, No. 49374, U. S. N. M., 1.3 inches in length, the only specimen, from Puerto Real, January 27, 1899.

Rubescens, reddening.

18. Auchenopterus cingulatus Evermann & Marsh, new species.

Head 3; depth 4.4; eye 5; snout 4.2; maxillary 2.2; interorbital 6; scales 2–29–7; D. IV–XXIV, the longest spines 3 in head; A. II, 16, the longest ray 2.25 in head; pectoral 1.3; ventral 1.8; caudal 1.6. Body rather long and slender, strongly compressed; head large, little compressed; snout moderately sharp; mouth large, maxillary reaching posterior border of eye, the lips heavy, the jaws subequal or the lower very slightly projecting; teeth conical and sharp, in more than one row in each jaw, most numerous in front; a patch on vomer; a nasal filament, a 3 or 4-branched supraocular tentacle, and a 4-branched nuchal tentacle, the branches of the latter each with a dark dot on their anterior surface. Dorsal originating over edge of preopercle, of spines only, the second slightly longer than first; second, third, and fourth graduated, the fourth comparatively short, thus forming a notch partly separating the first 4 spines from rest of fin; dorsal membrane joined low with caudal; anal free from caudal, about as high as dorsal, its thirteenth and fourteenth rays longest; first anal spine under tenth or eleventh dorsal spine; caudal rounded, shorter than head, of about 13 rays; pectoral large, reaching anal, of 12 rays; ventrals moderate, of 2 rays, the spine not evident. Lateral line running high to eleventh dorsal spine, here abruptly decurved two rows of scales, thence median to base of caudal.

Color in spirits: Body and head pale yellow; body with 4 heavy dark-brown vertical bars, each about 4 rows of scales wide, extending on the vertical fins; membrane of anterior dorsal spines, opercle, occipital, and scapular region, blotched with the same color; a dark bar backward and downward from eye across cheek, rather more than one-half width of eye; top of head between and behind eyes darkened; preorbital, maxillary, lips, and under part of head thickly punctulate with dark; dorsal and anal barred with the extensions of the wide dark body bars, and with the alternating narrower pale interspaces; caudal mottled or irregularly barred with grayish, its base with the plain pale-yellow ground color which is sharply separated from rest of fin by a curved dark line; posterior half of pectorals with dark bars formed of dots on the rays, the first bar plainest; basal half of pectoral pale; ventral with basal portion dark, the rest barred like pectoral.

A pretty and strongly marked blenny; four specimens obtained from the coral reefs at Ponce, and one at Puerto Real. The type, No. 49375, U. S. N. M., from Ponce, is 0.8 inches long, and none of the cotypes exceeds 1 inch.

Cingulatus, banded, from the conspicuous vertical bars.

19. Auchenopterus fajardo Evermann & Marsh, new species.

Head 3.25; depth 4.8; eye 4.2; snout 4.8; maxillary 1.7; mandible 1.5; interorbital 5.5; scales 2–37–8; D. XXIX, 1, the longest spine 2.3 in head; A. II, 17; pectoral 1.4; ventral 1.7; caudal 1.4. Body elongate, strongly compressed posteriorly; head moderate, little compressed; mouth large, the long and slender maxillary reaching beyond the posterior border of orbit; jaws subequal; teeth of upper jaw conical and sharp, in a patch in front, becoming one row posteriorly; teeth in lower jaw similar, but fewer and weaker; vomerine teeth in two series. Nasal, ocular, and nuchal tentacles present, all but the nasal about 5-branched. Dorsal origin over edge of preopercle, the first 4 spines graduated, the fourth shortest, thus forming a notch; dorsal ending with an unbranched soft ray, the joints visible under a strong lens; membrane of dorsal joined low to caudal; anal origin under eleventh dorsal spine and the decurved portion of lateral line; pectoral reaching past front of anal; ventral moderate, of 3 rays, the innermost shorter and slenderer.

Color in spirits: Body and head light reddish, becoming a little paler posteriorly; body with traces of 6 or 8 dark vertical bars extending on the fins, their margins ill-defined; breast pale, 2 dark reddish bars downward and backward from eye across upper and lower edge of cheek to opercle; maxillary blotched with dark; upper lip and tips of both jaws dark; lower part of head spotted with dark; a row of about 5 small dark spots on edge of preopercle; iris pink; dorsal and anal fins gray, except for the extensions of the dark bars of the body and a few white spots on the dorsal; a distinct ocellus on the twenty-second, twenty-third, and twenty-fourth dorsal spines and their membranes; base of caudal gray, like the ground color of dorsal and anal; posterior part of caudal with gray mottlings on the rays only, this portion separated from the basal part by a space without pigment on rays or membrane, making a distinct vertical bar; pectorals and ventrals mottled.

A handsomely-colored blenny, of which the collection contains but one specimen, the type, No. 49376, U. S. N. M., 1.63 inches long, taken at Fajardo, February 17, 1899.

Named for Fajardo, the type locality.

CORALLIOZETUS Evermann & Marsh, new genus.

Coralliozetus Evermann & Marsh, new genus of *Blenniidæ* (*cardonæ*).

Body slender and strongly compressed, without scales; head large, subcylindrical, bluntly pointed; mouth large; teeth not hooked, about eight enlarged conical ones in front of each jaw, smaller ones behind; vomer with teeth; dorsal fin with a notch between the rays and spines, the membrane connected with caudal; caudal fin rounded; pectoral large, ventrals small and inserted slightly in advance of pectorals. A strongly marked genus, conspicuous in appearance by its heavy head and thin body, probably related to *Ophioblennius*, from which it is technically separated by the absence of hooked canine teeth, the convex caudal, and the entire absence of a lateral line.

κορὰλλιον, coral; *ζητέω*, to seek.

20. Coralliozetus cardonæ Evermann & Marsh, new species.

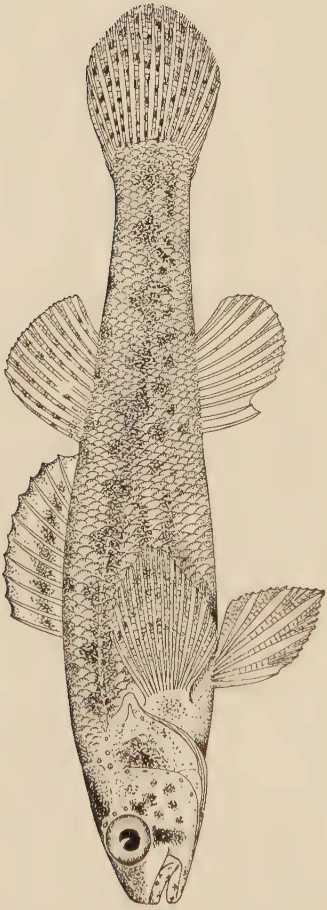
Head 4; depth 5.6; eye 5; snout 4; maxillary 2; D. xvii, 11; A. 21; pectoral 1.3; ventral 1.8; caudal 1.4.

Body scaleless, slender, much compressed; head large and heavy, not compressed nor depressed; snout very short and blunt; mouth large, horizontal, low in position, the maxillary reaching far beyond the eye; eyes small, close together, placed high and well forward; teeth conical, in a patch on the front of each jaw, an outer row of about 8 teeth (4 on a side) in each jaw, much enlarged; a single row of smaller teeth on sides of each jaw; teeth on vomer; a small flap at the nostril and two short filaments above eye, one much the smaller; no appendages at the nape. Dorsal fin long and high, of slender, flexible spines, and longer, soft rays, a notch between the soft and spinous portions; anal longer and lower than soft dorsal; anal and dorsal free from caudal; caudal rounded; pectoral large, wide as body, reaching anal or beyond; ventral small, inserted before pectoral, of 3 rays, the innermost very slender.

Color in spirits: Body dark red, much paler in one specimen; head everywhere bluish-black, this color dusted upon the body, particularly on the anterior portion; a pale-gray bar downward and backward across cheek; fins pale, except ventrals and front of dorsal, which have color of head; a row of small rosy spots along bases of anal rays, seemingly in the flesh; sometimes a similar fainter row along base of dorsal.

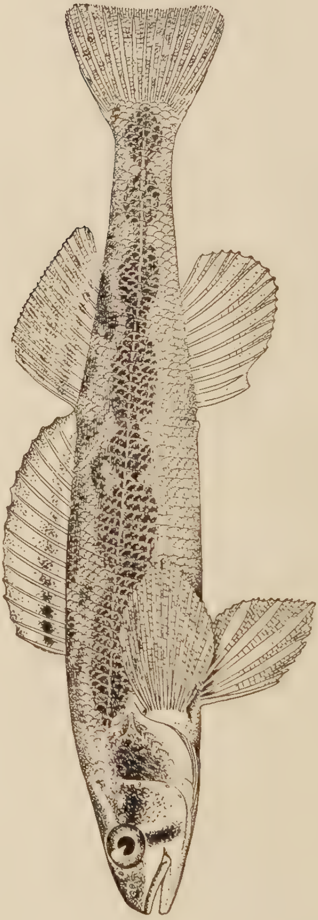
Three specimens, from 0.87 to 1 inch in length, taken on the coral reefs at Ponce on three successive days; the type, No. 49377, U. S. N. M., 1 inch long, collected February 1, 1899.

Named for Cardona, a little islet off Playa de Ponce, on the reef of which the type was collected.



ETHEOSTOMA AUBEENAUBEI Evermann. Type

About twice natural size.



HADROPTERUS MAXINKUCKIENSIS Evermann. Type

Slightly greater than natural size.

DESCRIPTIONS OF TWO NEW SPECIES OF DARTERS FROM LAKE MAXINKUCKEE, INDIANA.

By Barton Warren Evermann,
Ichthyologist of the United States Fish Commission.

During the summer and fall of 1899 the writer was engaged, under the direction of the Commissioner of Fish and Fisheries, in making a physical and biological survey of Lake Maxinkuckee, Indiana. While carrying on these investigations particular attention was, of course, paid to the fishes found in the lake. Careful studies were made of the abundance, distribution, feeding habits, and rate of growth of the more important species, and sufficient collections were made to supply data for cataloguing the species of fishes, mollusks, and crustaceans inhabiting the lake. Among the fishes obtained are two species of darters which appear to be new. As it is the intention to continue the study of this lake during another season, and as the detailed report upon the investigations will not be published until next year, it has been thought advisable to publish the descriptions of these new species in advance of the general report.

Lake Maxinkuckee is in the southwest corner of Marshall County, Ind., on the Logansport and Terre Haute railroad, 32 miles north of Logansport. It is about 2.75 miles long, from north to south, 1.75 miles wide, and is quite regular in outline. Like all the lakes of northern Indiana, it is of glacial origin. Its greatest depth, so far as known, is 86 feet. The bottom is of compact sand and gravel near the shore, then a wide bed of marl, and soft mud in the deeper parts. There are only one or two short reaches near the shore where the bottom is soft. The water is relatively pure and clear. The bottom temperature in summer is 47° to 50° F., while the surface gets as warm as 77° to 80°.

The lake is well supplied with aquatic vegetation, *Chara*, *Potamogeton*, *Myriophyllum*, *Ceratophyllum*, *Nitella*, *Vallisneria*, and *Scirpus* being abundant. At least 10 species of *Potamogeton* and 2 species of *Scirpus* are found. *Chara* is abundant, great beds of it covering the bottom in many places from near shore out to a depth of 12 or 15 feet.

The catchment basin of the lake is small. The tributary streams comprise one very small brook at the south end, a somewhat larger one at the southeast corner, and three small ones upon the east and northeast sides. They are short and sluggish and vary but little in size at any time. The total inflow from them is but a few gallons per minute.

The more important of these streams are the one at the southeast corner, popularly known as "the inlet," one near the middle of the east side, and one at the northeast corner, known as "Culver Inlet."

The stream on the east has been called Aubeenaubee Creek, from the Pottawattomie chief of that name who once owned the land on the east side of the lake. From this small creek the specimens of the new species were obtained. Aubeenaubee Creek rises in a small marsh and flows through a low, level meadow or prairie region. It is about 2 miles long, 4 feet wide, and averages only 3 to 6 inches deep, with deeper holes at intervals. Throughout most of its length the stream is overhung by bushes and briars and is full of sticks and brush. The bed and banks are of black mud with a mixture of sand. In some places the ground is quite boggy. The mid-day temperature of the water in this stream in summer is about 72°.

The fishes in Aubeenaubee Creek differ almost wholly from those in the lake proper, a fact illustrating clearly the importance of even slight differences in geographic location if accompanied by stable environmental differences. The principal fishes in this creek are *Semotilus atromaculatus*, *Campostoma anomalum*, *Umbra limi*, *Lucius vermiculatus*, *Notropis cornutus*, and young *Micropterus salmoides*. Craw-fishes were abundant.

The two darters described as new both occur in Aubeenaubee Creek, and nowhere else, so far as known. The nearest relative of the first of these species (*Hadropterus maxinkuckiensis*) is *H. scierus* which, though not occurring in Lake Maxinkuckee, is found in Yellow River, of the Kankakee drainage, only a few miles north, and also in the Tippecanoe River at Delong, some 5 miles south of the lake, and into which the outlet of Lake Maxinkuckee flows.

The other darter (*Etheostoma aubeenaubei*) here described is given full specific rank, though further investigation may show that its characters possess only subspecific value. It is evidently derived from *E. iowæ*, which is found in many of the streams of western Indiana and is somewhat abundant in Lake Maxinkuckee, but is not known to occur in Aubeenaubee Creek.

Etheostoma iowæ, in extending its range from its original center of distribution, in all probability found its way into Lake Maxinkuckee from the Tippecanoe River. Having once become established in the lake, individuals sooner or later began entering its tributary streams. Some of the individuals entering Aubeenaubee Creek, finding the conditions easy, remained and bred there, and thus a creek colony was established. It is altogether probable that for some years, possibly many, individuals from the colony would occasionally return to the lake and interbreed with individuals that had never left the lake. And the reverse would also take place—individuals from the lake would probably continue for many years to invade the domain of the creek colony and interbreed with its members. Under such conditions those of the colony going farthest toward the head of the creek were probably sooner freed from the influence of the lake and, breeding only among themselves, were modified most rapidly by the new environment. In time they became so well differentiated as to be readily distinguishable from the parent form in the lake.

But during the continuance of the migrations and countermigrations between the lake and the stream, there would be found in the lower part of the stream and in the lake about its mouth the progeny of the individuals from the lake and creek which had interbred. These would possess characters more or less intermediate between the parent species (*Etheostoma iowæ*) and the derived form inhabiting the creek. So long as these intermediate forms continued to exist the form found in the creek would be only an incipient species, and as such it would be a subspecies of *E. iowæ*, and would receive a trinomial name. But if, in course of time, invasions of one habitat by individuals from the other should cease, then the intergrading forms would, through interbreeding with the extreme forms, be gradually absorbed by them and finally disappear altogether. In the creek would then be found a form differing clearly and constantly from the lake form and without any connecting forms. Under these circumstances the form in the creek, as well as that in the lake, must rank as a distinct species.

This is the present condition, so far as our investigations have enabled us to determine. There is no difficulty in distinguishing individuals taken in the lake from those found in the creek, and neither form seems to invade the habitat of the other. Large collections were made, not only of the fishes inhabiting the lake, but also of those in the creek. The latter was carefully seined twice from its source to its mouth, and not a single example of *E. iowæ* or any form showing intergradation was seen. Similarly careful investigations were made in the lake without discovering any individuals of the creek form or any showing intergradation. Whether further collecting will discover connecting forms can not, of course, be stated. The small size of the creek and of the lake, and their close geographic relation, render it almost certain that individuals of the one form would occasionally invade the habitat of the other, and vice versa. While the environment of the creek is markedly different from that of the lake, it is improbable that a change from one to the other would prove disastrous to the individuals concerned. Some of such individuals would, it seems, be able to survive, and some would probably interbreed with individuals of the other form whose habitat they had invaded. This was quite likely the condition in the beginning, and the creek form, so long as it remained connected with the parent species by the intergrading forms resulting from such interbreedings, would be a subspecies of the parent species. But, as already stated, no such connecting forms have yet been found, and the form inhabiting the creek is a distinct species.

There is one other condition worth considering. Let us suppose, after the creek colony had become well established, and for many generations had not intermingled in any way with the parent species in the lake, that the habits of one or the other, or both, should change somewhat and that they should again begin to invade each other's habitat, and to interbreed. However rarely this might occur, no one will deny its possibility. The result of this interbreeding would be the appearance of individuals possessing morphological characters more or less intermediate between the lake and the creek forms. In other words, individuals would be found showing that the two forms intergrade and placing them again in the relation of species and subspecies. If we could *know* this to have been their history, however, we would certainly not place them in the relation of species and subspecies. We would regard them as two distinct species, and the individuals which seem to show intergradation we would call hybrids, which they really are. But we can rarely, if ever, *know* that such has been the history. So long as intergradations are found connecting the two forms, the one last discovered must be regarded as a subspecies of the other, but in the present case no intergradations seem to exist, and the relation is that of two distinct species.

Hadropterus maxinkuckiensis Evermann, new species.

Head 3.75; depth 6; eye 4.5; snout 4.2; maxillary 3.25; mandible 2.75; interorbital 6; pectoral 1.3; ventral 1.4; D. XIV, 13; A. II, 9; scales 7–62–10.

Body rather long, slender, and subterete; caudal peduncle somewhat compressed, its least width one-half its least depth; head rather long, snout pointed; mouth rather large, somewhat oblique, maxillary reaching anterior edge of pupil; lower jaw included; eye rather large, slightly above axis of body; interorbital moderately wide, nearly flat; gill-membranes free from each other and from the isthmus; opercle with a rather long flap and stout spine; premaxillaries not protractile; fins rather large; distance from origin of spinous dorsal to tip of snout slightly greater than base of spinous dorsal, or nearly twice base of soft dorsal; longest dorsal spine 2.75 in head; soft dorsal higher than spinous portion, 2.25 in head, the free edge gently curved; origin of anal under that of soft dorsal, its base 1.9 in head; caudal slightly emarginate.

Scales firm and strongly ctenoid; lateral line complete and straight, beginning over opercular spine; top of head and an oblong area on nape naked; space in front of spinous dorsal with small embedded scales; opercle with about seven rows of scales; cheek with a few small embedded scales; breast naked, except two or three partially embedded scales on median line; one large scale between ventrals; belly naked anteriorly, but with about 10 enlarged, stellate scales posteriorly; space between ventrals broad, equal to width of base of ventral; preopercle smooth.

Color in life essentially as in *H. scierus;* mottled and vermiculated with light and dark brown, or blackish, the middle line of back with about 9 large, roundish, dark, confluent areas, each surrounded by a wavy, whitish line; middle of side with about 7 large confluent dark spots, the anterior two largest and longest, the third small, the fourth large, and the remaining three progressively smaller; under parts yellowish white; top of head dark; a narrow whitish line around upper posterior part of orbit; a broad black line downward from eye; upper part of preopercle and nearly whole opercle dark, each dusted on lower part; cheek dusted with fine dark specks; an irregular pale area at anterior end of lateral line; spinous dorsal ashy, membrane of the first three spines black on middle portion, the other membranes dark, but less distinctly so; tips of last few spines dark; soft dorsal light brownish or grayish, crossed near the base by a series of dark spots and above by two series of whitish spots; caudal spotted with white and brown; anal white, dusted with brownish; ventrals whitish, with fine dark dustings; pectoral whitish, yellowish at base, followed by alternating series of dusky and whitish spots.

This species differs from *H. scierus* chiefly in the much larger mouth, the longer maxillary, the larger scales, the fewer scales on the opercle and cheek, the free gill-membranes, the smooth preopercle, and closer approximation of the dorsal fins.

One example, 3.5 inches long, taken in Aubeenaubee Creek, the eastern inlet of Lake Maxinkuckee, about half a mile from the lake, August 4, 1899.

Type No. 49378, U. S. N. M. Evermann & Scovell, collectors.

Etheostoma aubeenaubei Evermann, new species.

Head 3.6; depth 5; eye 4; snout 5; maxillary 3; interorbital 5; D. x–11; A. II, 8; scales 4–58 to 63–9, 8 to 24 pores.

Body rather elongate, not much compressed except posteriorly; head rather short; snout short, somewhat decurved; mouth moderate, slightly oblique, lower jaw included, maxillary reaching past front of orbit; eye rather small, above axis of body; premaxillaries not protractile; gill-membranes free from the isthmus and each other. Fins not large, the dorsals usually distinctly but narrowly separated, sometimes scarcely separate; origin of spinous dorsal one-third distance from tip of snout to base of caudal; outline of spinous dorsal gently rounded. the longest spine about 3 in head; longest dorsal ray about 2; first anal spine longer, and slightly stronger than second, 3 to 3.5 in head; longest anal ray about 2; pectoral short, about 1.3 in head; ventrals close together, about 2 in head; caudal rounded, 1.5 in head. Scales rather small, rough-ctenoid; lateral line incomplete, usually developed on only 8 to 24 scales at anterior end; cheek usually naked, or with a few small, more or less embedded scales; opercle usually about half-scaled, sometimes with but few scales; breast always naked; belly with ordinary scales; nape usually densely and regularly scaled, occasionally some scales embedded; preopercle entire; opercular flap moderate, broad; opercular spine rather small; no humeral spot or process.

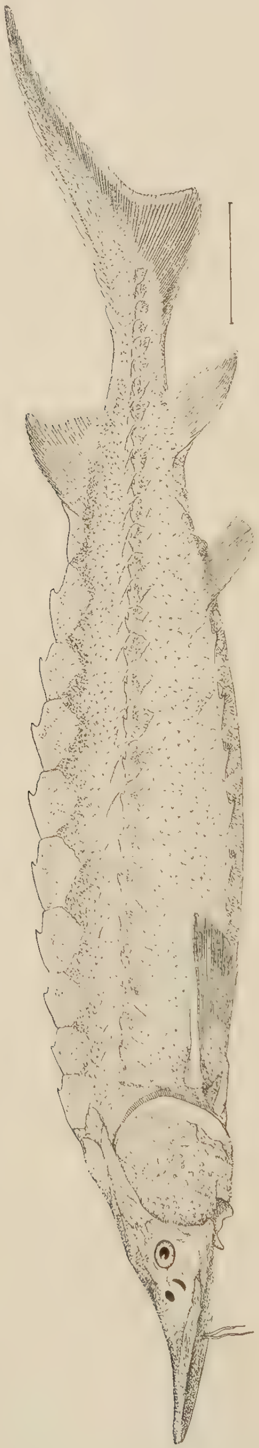
Color in life, greenish brown above, side with about 12 or 13 vertical, dark blotches, separated by pale orange-red areas of similar size; another series of similar but smaller orange blotches along lower part of side anterior to anal fin; under parts whitish; caudal peduncle grayish; head dark above; opercle and cheek dark, with greenish shade; a dark line downward from eye; snout grayish; spinous dorsal with a narrow dark border, below which is a broad orange band, then a broad but irregular dark band near base of fin; soft dorsal and caudal barred with white and grayish, the latter in spots on the rays; anal and ventrals without markings; pectoral somewhat dusky.

This species is close to *E. iowæ*, from which it is evidently descended, and from which it differs in the almost naked cheek, the less complete scaling of the opercle, the somewhat longer maxillary, more oblique mouth, much closer approximation of the dorsal fins, and the coloration.

Many examples, each about 2 inches long, taken in Aubeenaubee Creek, the east inlet of Lake Maxinkuckee, August 4 and 23, and on other days in August and September, 1899.

Type No. 49379, U. S. N. M. Evermann & Scovell, collectors.

PLATE 18.



ACIPENSER STURIO Linnæus. *Common Sturgeon.*

THE STURGEON FISHERY OF DELAWARE RIVER AND BAY.

By John N. Cobb,
Agent of the United States Fish Commission.

The great decline in the catch of sturgeon in American waters has attracted the earnest attention of all who are interested in the fisheries. This decline has not been peculiar to the American fisheries, but is noted in nearly all countries in which sturgeon fishing is prosecuted.

The principal sturgeon fisheries of the United States are in Delaware Bay and River, the Great Lakes, South Carolina, and Columbia River. The Delaware fishery, of which the present paper treats, exceeds all others. It is carried on from Pennsylvania, Delaware, and New Jersey, although the interests of Pennsylvania are very slight.

Both the common sturgeon (*Acipenser sturio* Linnæus) and the short-nosed sturgeon (*Acipenser brevirostris* Le Sueur) are found in the Delaware River, but only the former is put to any commercial use there. It attains a large size, a length of 10 feet being not uncommon. *A. brevirostris* rarely exceeds 3 feet in length, and therefore is not gilled in the large-meshed nets used. Some are probably taken at the shore seine fisheries along the river and in the shad gill nets.

HISTORY OF THE FISHERY.

The earliest settlers to this country were especially struck at the immense numbers of sturgeon seen in the Delaware, and their letters to the home folks in England and Germany contain frequent references testifying to their wonderment. Mr. William E. Meehan, in "Fish, Fishing, and Fisheries of Pennsylvania,"* writes as follows:

> William Penn made special note of this fish. Peter Kalm speaks of it, and others tell of its capture and great size. Until comparatively a few years ago sturgeons were still plentiful. Men not yet 60 years old say that even after they had passed their majority it was not an uncommon sight to see several sturgeon during a single trip between Camden and Philadelphia, jumping in the river.
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> Mr. Samuel Williams, a resident of Burlington, N. J., now in his eighty-fourth year, says that when he was a boy on one occasion he went with his father on a shad-fishing trip in the lower Delaware and during it he saw thousands of this huge fish. Once on this trip his father and companions were compelled to take their nets in with great speed in order to save them from utter destruction; as it was, many fathoms were badly torn by this fish. The sturgeon passed their boats in such vast numbers that in a little while the occupants had killed and secured eleven. This was as many as they could take home and, as the run continued, they slew many more on the principle that it was a fish not only of scarcely any value, but was actually a nuisance in the river on account of the damage caused the nets.

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* Report of the State [Penna.] Commissioners of Fisheries for the years 1892, 1893, 1894, pp. 257-392. 1895.

Mr. Larzalere states that when he was a young man one night he, with a number of young men and women, went rowing on the Delaware in two boats. While proceeding up the river only a few feet apart a large sturgeon, 6 or 7 feet long, jumped from the water and nearly capsized one of the boats, and the occupants were thoroughly drenched and frightened. The same gentleman also stated that William Stockton, the father of the Rev. Thomas H. Stockton, for a space chaplain of the House of Representatives at Washington, was at one time out boating when a large sturgeon actually jumped into the boat and was secured.

Mr. John Fennimore related the following:

> "Many years ago there was a little steamboat which plied the Delaware above Philadelphia called the *Sally*. On each side, near her bows, were two large round windows, which, in the summer time, were often open. One day when the *Sally* was on one of its trips up the river, a large sturgeon in jumping made such a leap that it passed clear through one of these windows and landed in the vessel, where it was killed."

Stories like the foregoing are quite common and many of them are well authenticated, and they serve as nothing else can to illustrate how numerous this species of fish were in the Delaware River, for until recent years the sturgeon seemed to be little esteemed by the people living along this great stream. Nearly all the old fishermen say that in their boyhood days few ate sturgeon except the colored people, though occasionally a family would fry a few steaks and serve them with cream. The roe was considered worthless except as bait with which to catch eels and perch or to feed to the hogs. From 3 to 4 cents a pound were the best prices that could be obtained retail for the meat, and it was not often that more than 25 or 30 cents could be had for a whole fish.

Mr. John Fennimore made a practice of fishing for sturgeon with nets at Dunks Ferry, now Bristol, in the latter part of the twenties and until about 1835. Mr. Vanschiver and Mr. McElroy, two other fishermen of that neighborhood, also carried on the same business. They used a 12-inch mesh and drew their nets over the bar near the Pennsylvania side, a favorite spot for the sturgeon. Sometimes 25 or 30 were taken at a single haul. The fish brought very little money, however, seldom more than 30 cents apiece, and sometimes as low as 12½ cents. Mr. Williams says that a favorite method with many fishermen of catching sturgeon in the month of August, prior to 1835, was with the harpoon, and that the favorite spot for this method was about Dutch Island, near Bordentown.

The exact time when the fishery for sturgeon was taken up to any considerable extent is doubtful. Mr. Benedict Blohm, of Penns Grove, N. J., was undoubtedly one of the earliest to engage in the business with gill nets, and was the first to put up caviar, which he did about the year 1853. For a number of years the business struggled along, owing to the low price received for caviar and the prejudice prevailing against the use of the flesh. After 1870 the business expanded very rapidly. Previous to the use of special gill nets for sturgeon many were taken in the shore seine fisheries, 117 being obtained in one haul of the Fancy Hill Fishery in Gloucester County in the early seventies. Very little use was made of these for a long time; but, as people began to develop a taste for the sturgeon flesh, the fish was sold to peddlers, who dressed them and peddled the meat throughout the surrounding country. Of late years, however, but few are taken in the seines.

The smoking of sturgeon flesh was begun on a small scale in New York City about 1857, and later in Philadelphia. This has caused a fairly steady demand for the flesh at a remunerative price, and has been a large factor in the great development of the industry.

The first person to engage in the business in Pennsylvania waters with gill nets was Mr. Henry Schacht, of Chester, in 1873. He located first on Ridley Creek, whence he removed to Chester Creek. A few years later he purchased Monas Island, opposite Chester. Here, by means of piles, he built a pen in which he could keep the fish alive until the market price was satisfactory.

SEASON, ABUNDANCE OF FISH, ETC.

The fishing season usually begins the early part of April and closes about the middle of June, depending on the run of fish—sometimes closing earlier, and again, if fish are plentiful, continuing until the end of the legal season, June 30. The movements of the fish during the season are thus described by Professor Ryder:*

> As the season advances the spawning schools move upward from the salt waters of the Delaware Bay, and in the neighborhood of Fort Delaware and Delaware City, 45 miles south of Philadelphia, where they pass into brackish or nearly fresh water. From this point southward 20 miles, and northward as many more, it is probable that a large part of the spawning now occurs. Those that escape the meshes of the hundreds of sturgeon nets which are every day stretched across their spawning-grounds go farther north to get rid of their burdens of ova.
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> The upward movements of the school seem to be affected to some extent by a rise of the prevalent temperature of the water and air, thus making the fishery for the time more profitable. Conversely, a decline in the prevailing temperature is often apparently followed by a diminution in the numbers of fish on their way up the river, and a cold, late season retards the appearance of the fish from the salt waters farther south. A very rainy season, which has caused an unusually abundant flow of fresh water down the river, also interferes with their early appearance in the waters above Delaware City. This is supposed to be due to the fact that the water becomes fresh farther south than usual where the schools then remain to discharge their spawn. The fishing season at Delaware City is at its height during the months of May and June, but fish are caught during the summer and autumn and until as late as September and October.

There has been an almost continuous decrease in the number of sturgeon taken by the fishermen for some years back. One of the best methods of showing this is from the average number of fish taken in each gill net per season. The following information from the reports of the U. S. Fish Commission and from the statements of leading fishermen and dealers will doubtless prove instructive: In 1890 the average catch of sturgeon per net was 60; in 1891 it was about 55; in 1892, 43; in 1893, 32; in 1894, 26; in 1895, 32; in 1896, 27; in 1897, 20; in 1898 it was only 14, while in 1899 it dropped as low as 8 fish to the net.

The table following shows the catch of sturgeon for the years 1890, 1891, 1892, and 1897 for all three States and the catch for New Jersey alone in 1898. Pennsylvania and Delaware were not canvassed for 1898 The weights are for round fish, or just as taken from the water, and the value of the caviar is included.

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* The sturgeon and sturgeon industries of the eastern coast of the United States, with an account of experiments bearing upon sturgeon culture, by John A. Ryder. Bull. U. S. Fish Comm. for 1888, pp. 231-328.

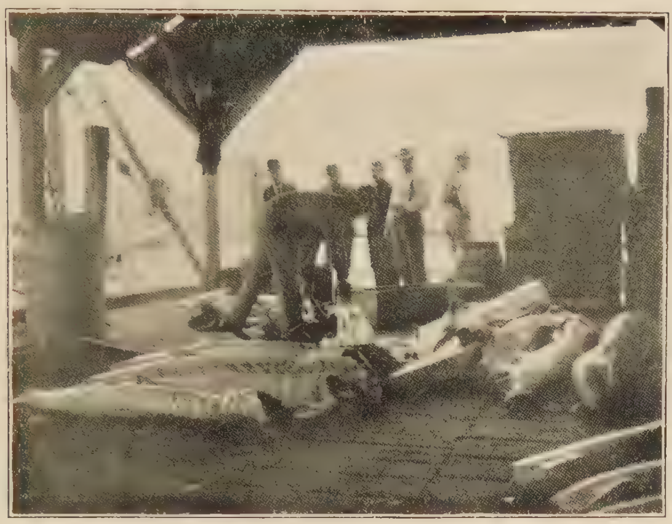
Table showing the catch of sturgeon on the Delaware River and Bay for the years 1890, 1891, 1892, 1897, and 1898.

State and county.	1890.		1891.		1892.		1897.		†1898.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Pennsylvania—										
Bucks	58, 650	$810	52, 700	$640	60, 180	$728	985	$53	....	......
Delaware	....	......	....	......	....	......	8, 960	207	....	......
Total	58, 650	810	52, 700	640	60, 180	728	9, 945	260	....	......
Delaware—										
Newcastle	995, 600	24, 950	1, 074, 450	27, 068	877, 680	21, 953	312, 300	22, 713	....	......
Kent	306, 000	4, 400	230, 350	3, 380	173, 910	2, 557	143, 100	11, 005	....	......
Sussex	....	......	....	......	....	......	11, 850	1, 032	....	......
Total	1, 301, 600	29, 350	1, 304, 800	30, 448	1, 051, 590	24, 510	467, 250	34, 750	....	......
New Jersey—										
Burlington and Mercer	....	......	....	......	....	......	*300	8	*510	$24
Camden	....	......	....	......	....	......	*1, 000	25	*450	12
Salem	3, 179, 575	78, 217	3, 067, 740	75, 800	2, 738, 455	56, 153	1, 301, 226	57, 473	873, 750	62, 503
Cumberland	483, 350	11, 233	428, 700	9, 562	390, 125	7, 310	547, 915	27, 493	381, 530	31, 605
Cape May	....	......	....	......	12, 750	255	100, 980	4, 431	42, 075	2, 128
Total	3, 662, 925	89, 450	3, 496, 440	85, 362	3, 141, 330	63, 718	1, 951, 421	89, 430	1, 298, 315	96, 272
Grand total	5, 023, 175	119, 610	4, 853, 940	116, 450	4, 253, 100	88, 956	2, 428, 616	124, 440	....	......

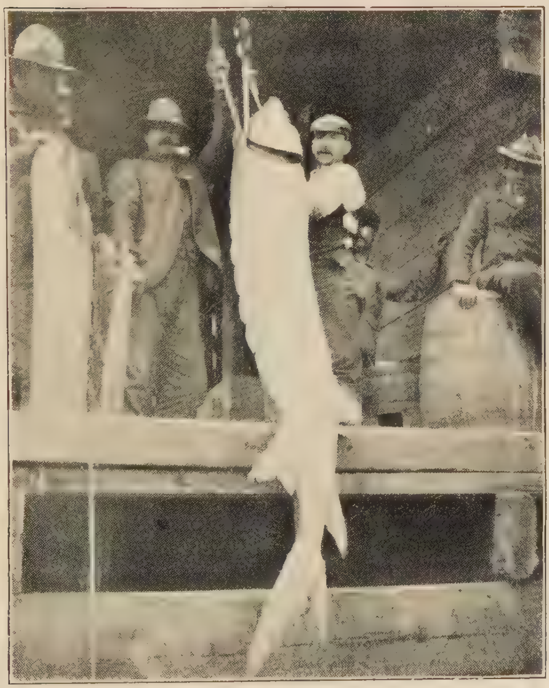
* Taken incidentally in seines. † Pennsylvania and Delaware were not canvassed for 1898.

The best method of improving the condition of this fishery is by artificial propagation. In 1888 Prof. John A. Ryder, after an exhaustive investigation, under the auspices of the United States Fish Commission, conclusively proved that this work was feasible if spawn could be secured in the proper condition; yet little, if anything, has been done in this direction. Mr. L. G. Harron, under the auspices of the Commission, took up the work at Delaware City, Del., in 1899, but unfortunately he was unable to secure any ripe fish, so his efforts came to naught. The difficulty is in getting the ripe spawn and milt at the same time. The soft spawn is the only kind that can be used by the fish-culturist; as this can not be utilized by the fishermen in making caviar, they would readily turn over to the Commission all that they get. Some seasons, however, there seems to be very little of this kind of spawn to be had. The New Jersey fishermen say that ripe spawners are generally caught around Benny's Buoy, about 6 miles below Bayside, between the 10th and 17th of May. The buck sturgeon are usually about a day or two behind. The Cohansey River empties into the bay near here, and it is probable that the fresh water from the river causes more favorable conditions for the spawning of fish.

The proper protection of the "mammoses" or young sturgeon would benefit the sturgeon fishery. For some years past these have been destroyed by the shad gill-netters and other fishermen on the river and bay merely because they injure the nets by their struggles. These young sturgeon are very common as far up the river as the Trenton Falls, and in 1898, 100 of them were captured in a shore fishery near Newhope, Pa., but it is unusual to find them that far up the river. There is quite a widespread belief among the fishermen that the "mammoses" are not young sturgeon, or, at least, are not the young of the common



CARCASSES OF STURGEON READY FOR SHIPMENT AT BAYSIDE, N. J.



LANDING A STURGEON ON THE WHARF AT BAYSIDE, N. J

sturgeon, *A. sturio*. This belief probably arises from a considerable difference in appearance which exists between the full-grown *A. sturio* and its young. In some instances the fishermen may have mistaken *A. brevirostris*, the short-nosed sturgeon, for the young of *A. sturio*.

In 1891 the State of New Jersey passed the following law protecting the "mammoses," or young sturgeon:

> *Be it enacted by the senate and general assembly of the State of New Jersey*, That it shall not be lawful for any person or persons to cast, draw, set, anchor, drift, or stake any gilling net, or any other device or appliances of any kind whatsoever, for the purpose of catching fish commonly called or known as mammose (which are young sturgeon under 3 feet in length) in the waters of the Delaware Bay, river, and their tributaries, within the jurisdiction of the State of New Jersey; and any person or persons fishing with gilling nets, drift nets, shore, seine nets, or any kind of nets, devices, or appliances whatever in the Delaware Bay, river, or their tributaries, within the jurisdiction of the above-named State, who, on lifting, drawing, taking up, removing, or underrunning any of said nets, devices, or appliances, shall find young sturgeon or mammose under 3 feet in length entangled or caught therein, shall immediately, with care and with the least possible injury to the fish, disentangle and let loose the same and transmit the fish to the water without violence. Any person or persons violating any provisions of this section, or having in their possession young sturgeon or mammose under 3 feet in length, either for consumption or for sale, or who is known willfully to destroy the same, for so offending shall, on conviction thereof, be punished with a fine of $10 for each and every fish so caught, sold, or destroyed, and in default of paying such fine, on being convicted thereof, to be imprisoned in the county jail for 30 days.

A few years later the State of Delaware adopted practically the same law, but as Pennsylvania has not yet taken action on this subject the law has so far had very little beneficial effect on the fishery.

FISHING-GROUNDS, FISHERMEN, ETC.

The fishing-grounds on the New Jersey side are located between Cape Shore and Fishing Creek, in Cape May County, and Penns Grove, in Salem County, the principal fishing being near Bayside. The more important fishing-camps are at Cape Shore, the mouths of Fishing Creek and Cohansey River, Bayside, and the mouths of Alloways and Hope creeks. A small fishery is also carried on in the Maurice River.

In Delaware the principal grounds are between Mispillion Creek and Delaware City, and the principal camps are at the mouth of Mispillion Creek, at Bowers Beach, Rays Ditch, at the mouth of Blackbird Creek, Port Penn, and Delaware City.

In Pennsylvania the fishery is usually carried on from Marcus Hook and Chester. Owing to the closing of the season on June 30, the fishing by Pennsylvanians in this locality is practically a thing of the past, as the fish do not usually reach there until after that date.

In 1897 978 fishermen, 80 shoresmen, and 45 transporters were engaged in this fishery. Two men usually form the crew on the transporting vessels, although three and four men are sometimes employed. In the fishing boats two men are engaged. The salary of the head man in the fishing boat averages about $45 per month with his grub, while the other man receives about $30 per month with grub. The grub bill of a camp usually averages about $2.50 a week for each man.

VESSELS, BOATS, ETC.

In New Jersey the principal railway shipping-point is Bayside, while in Delaware most of the product is handled at Delaware City. As most of the camps are located some few miles either up or down the bay from these places, it is necessary to ship the caviar and carcasses by vessel. In 1897 the New Jersey fishermen used 25 vessels, with a net tonnage of 540, and valued at $31,650, as transporting or "market" vessels, or as "lay" vessels. In Delaware 6 vessels, having a net tonnage of 145 and valued at $5,500, were used, while none were used in Pennsylvania.

If the fishermen have their camp located near a swampy shore, they usually engage a vessel of anywhere from 8 to 50 tons. This is taken to a convenient sheltered spot near where they intend working and is securely anchored. The fishermen then make their headquarters on this vessel for the rest of the season, eating, sleeping, and preparing their catch for market on board. This is called a "lay" boat. The cost of maintaining such a vessel is usually about $100 per month for rental or charter, with the additional expense, in most cases, o provisions for one man who accompanies the vessel. Others tow to the fishing-grounds immense scows, with a cabin at each end, and use them for camps. One of these cabins is much larger than the other, and is used for sleeping quarters, while the butchering of the sturgeon and the preparing of the caviar is carried on in the smaller cabin. Still others use the ordinary houseboat, or cabin boat, which is nothing but a house built on a small scow.

Scow boat used in sturgeon fishing.

When the ground is firm and the location convenient, the camps are built on the shore and are usually only rough shacks of unplaned pine boards. Owing to the depredations committed at the isolated camps when the sturgeon fishermen are not engaged in the business, it is becoming more common to use vessels or scows as camps, as they can be removed to a place of safety at the end of each season.

Vessels averaging about 25 net tons each and of both schooner and sloop rig are used in transporting the carcasses and caviar from the camps to the shipping-points and in carrying supplies to the camps. Most of them come from the Chesapeake Bay, they being chartered more cheaply than local vessels. The cost is usually about $100 per month and the provisions for the men in charge of the vessel.

Transporting vessel used in sturgeon fishing.

In the season of 1897 a small naphtha launch was used at Bayside in towing the fishing boats in and out in calm weather and unfavorable winds. In 1898 a small steamer of 7 net tons, valued at $10,000, was used in towing boats and other work at Fishing Creek and Bayside.

The fishing boats used are large open "gilling skiffs," and are locally known as "sturgeon skiffs" in contradistinction to "shad skiffs," which are very similar, but smaller. They are about 25 feet long on the keel, about 8 feet beam, and will carry nearly 5 tons. Their average value is about $160 each.

APPARATUS AND METHODS OF FISHING.

For the capture of sturgeon gill nets are used exclusively. These usually average about 250 fathoms in length, and are worth, all rigged ready to be put in the water, $75 each. They are usually about 28 meshes, or 21 feet, in depth and have a stretch mesh of 13 inches. About ten years ago a mesh of 16 inches was used, but owing to the decrease in the number of large sturgeon the mesh has been reduced so that more small fish will be taken. A few sturgeon are also taken incidentally at the seine fisheries along the river, but they form a very insignificant part of the total catch.

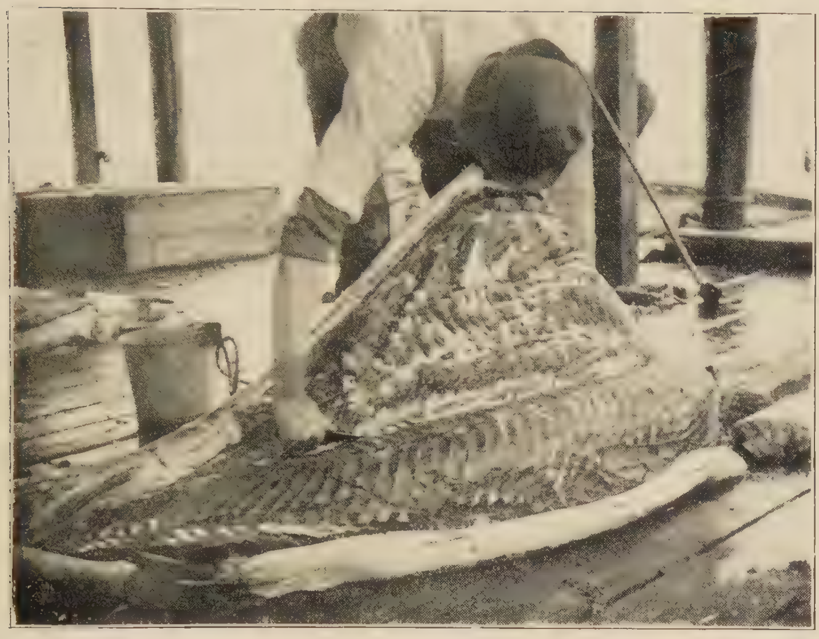
The nets are always drifted. The fishermen generally go out about two or three hours before slack water and put their nets overboard. As the fish feed near the bottom, the nets must be arranged so as to reach close to the bottom. This is done by sinking the cork-line the necessary distance below the surface by means of extra heavy leads on the lower line, and the net is kept track of by attaching to it wooden buoys, called "dabs," by means of ropes. The fishermen drift along behind their net, usually about the middle of it. Should a buoy indicate that anything has been captured in the net, the fishermen at once take in that section, and if a fish has been gilled it is hauled into the boat and the net is reset. The sturgeon are taken aboard by means of long-handled hooks of round iron. Although from 6 to 10 feet in length, they struggle very little when gilled. When being hauled into the boat they seem to lose all heart, and are generally rolled in like a log. They make a rather difficult object, however, to get into a boat, owing to their great bulk and weight. The two men forming the crew have all they can conveniently handle when a big female sturgeon is taken. A fisherman at Bayside has been known to handle a 7-foot female single-handed, but this was a very unusual occurrence.

The net is usually fished but once a day. It is taken in at slack water and the fishermen come back to camp with the ebb tide.

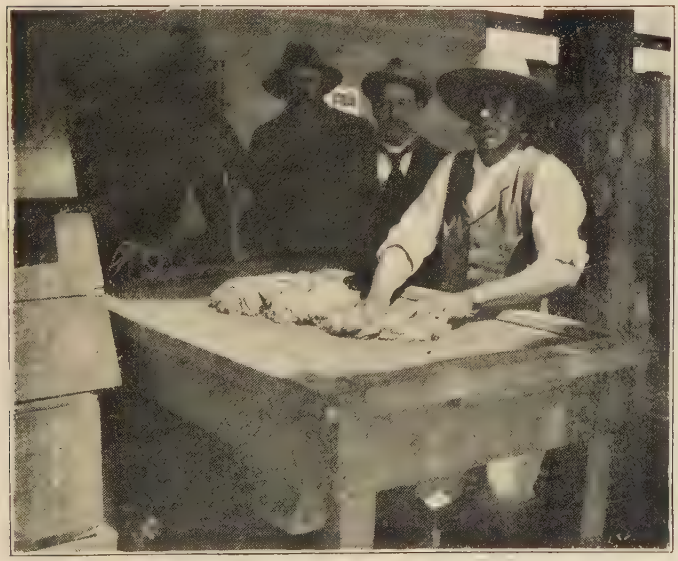
A considerable saving could doubtless be effected if the skiffs were fitted up with small naphtha engines and paddles or screws. On the river the shad-gillers have fitted up some of their skiffs in this way. With such an arrangement the fishermen would be independent of the weather. It is important that sturgeon be landed at the butchering floats or wharves at the earliest moment possible, and when the wind is adverse it is difficult to do this without the exhausting operation of rowing, and even this is impossible if the skiff is very far from the camp.

CLASSIFICATION AND VALUE OF FISH.

The fishermen classify the fish as follows: "Cow" fish, female sturgeon which have hard roe, which is the kind used in preparing caviar; "runners," female fish with soft spawn which is running out of the fish and is generally too soft to be used for caviar; "slunkers," female fish which have already spawned; "bucks," male fish of all kinds. The last three are valuable only for the flesh. Two-thirds of the catch is



SKINNING A STURGEON.



SEPARATING THE EGGS OF THE STURGEON FROM THE MEMBRANE.

of "cow fish," while the remaining one-third is composed of "bucks," "slunkers," and "runners." The "bucks" will not average more than one-tenth of the total catch.

A few of the fishermen, with small capital, or little experience, sell their fish to other fishermen or dealers in the round state, or just as taken from the water, and the buyers prepare the caviar and flesh for market. In 1897 the average prices paid for the round fish were as follows: "Cow" fish, from $10 to $12 each; "bucks," "slunkers," and "runners" $1.50 each. In 1898 "cow" fish sold for $25 each, while "bucks," "slunkers," and "runners" sold for $2 each. In 1899 various prices were paid for "cow" fish, as there was a general demand for them, one fisherman receiving as high as $65 for an extra large one. The number of fishermen who put up their own caviar increases each season, as the possible profit is a great incentive to raise the capital needed.

HANDLING THE FISH.

The fisherman endeavors to land "cow" fishes alive. As soon as they are landed on the wharf, or the butchering float, the tail is severed with an ax, so that the blood may escape and the fish die quickly. After a few minutes the operator makes eight short longitudinal slits in the abdomen, four on each side of an imaginary line drawn down the center of the fish. These are for "hand holds" later in the work of skinning the fish. A long slit is then made down the center of the abdomen, so that when the skin is thrown back the whole abdomen is exposed to view. Should it be a "cow" fish, with the proper kind of roe, the operator cuts the inclosing membrane, takes out the roe, and places it in pails. The head is then cut off with an ax or cleaver. In preparing the carcass for shipment the skin is carefully separated from the body on the sides and then along the back by means of knives, after which the backbone is cut out, leaving the fish boneless. Some sturgeon are shipped, however, without being skinned, these going to the Philadelphia markets. The skinned carcasses are usually shipped to New York, packed in ice, while the undressed fish are merely tagged and shipped without any further preparation.

As taken from the water, the females usually average about 350 pounds each, while the males average about 65 pounds each. When dressed for shipment, the carcasses of the females will weigh about 100 pounds, while the carcasses of the males will average about 35 pounds.

At Bayside a small business is carried on in the preparation of fertilizer and oil from the refuse of the sturgeon. For this purpose a large building is used, containing machinery for cutting up and extracting the oil from the refuse, and the necessary drying floor for drying the resulting scrap. The whole plant is worth about $10,200, and about 5 men are employed in the work during the fishing season.

The scrap, after the oil has been extracted, is treated with acidulated rock and potash, and makes a very good grade of fertilizer, which is sold to farmers in the vicinity. In 1898 this fertilizer sold for about $18 a ton. The oil is put up in barrels holding about 50 gallons each, and in 1898 brought an average of $10 per barrel. This business was formerly quite extensive, but has greatly decreased owing to the decline in the catch of sturgeon and the heavy competition with other products.

No use is made of the air-bladder, or sound, of the Delaware sturgeon, owing to its coarseness.

PREPARATION OF CAVIAR.

By far the most valuable by-product obtained from the sturgeon is the roe, from which the valuable commercial product called caviar is prepared. For this only the hard roe of the "cow" fish is supposed to be used. The manner of preparation is as follows:

After the eggs have been removed from the fish, they are placed in large chunks upon a stand, the top of which is formed of a small-meshed screen. On the under side is arranged a zinc-lined trough, about 18 inches deep, 2 feet wide, and 4 feet long. The operator gently rubs the mass of eggs back and forth over the screen. The mesh is just large enough to let the eggs drop through, and as they are separated from the membrane by the rubbing, they fall through into the trough and are thence drawn off into tubs by means of a sliding door at the end of the trough. After all the roe has been separated, the tub is removed and a certain proportion of the best Lüneburg (Germany) salt added to the roe, after which the operator carefully stirs and mixes the mass with his hands. The most delicate part of the whole operation is in the manner of mixing. No direct rule can be given for doing this portion of the work, as the condition of the roe regulates the time consumed and the manner of handling. It requires practical experience to become proficient.

After adding the salt the mass of eggs first dries up, but in 10 or 15 minutes the strength of the salt draws from the eggs their watery constituents and a copious brine is formed, which can be poured off when the tub becomes too full. The salted eggs are poured into very fine-meshed sieves, which hold about 10 pounds each. In the caviar house are usually arranged long, sloping boards, with narrow strips nailed on each side. On these the sieves are placed, and are left there from 8 to 20 hours in order to thoroughly drain. The eggs have now become the caviar of commerce, and are transferred to small casks, of either oak or pine, which have been steamed in order to prevent any possible leakage; the casks are covered and allowed to stand until the gas escapes and the eggs settle. The vacant space caused by the settling is then filled, and the cask headed up and put in a cool place until ready for shipment. The casks cost about $1 each and hold about 135 pounds net. It requires about 11 quarts of salt to prepare a keg of caviar.

Formerly only the hard roe was used in making caviar, but some of the fishermen have become so expert that they can handle roe which is medium soft and still prepare a fair grade of caviar. Others who are not quite so scrupulous as the majority even put up the quite soft roe;

as the eggs, when ripe, have become detached from the membrane, it is not necessary to run it through the sieve. They are put in a pickle to cure them, and, after being allowed to drain, are placed in the middle of a cask, with good caviar at the top and bottom.

The fisherman's work usually ends at this point, as the buyers for the foreign and domestic firms which handle caviar are at the fishing centers during the season ready to buy and pay cash for the product.

An idea of the great increase in the value of caviar can be gathered from the following: In 1885 caviar sold for from $9 to $12 a keg; in 1889, 1890, and 1891 the price averaged about $20; in 1892, 1893, and 1894, about $40; in 1897 it was $46.58; in 1898 the price was about $73 a keg, while in 1899 the price went as high as $105 a keg.

The greater part of the caviar produced in this country is shipped to Germany, although a considerable domestic trade has been established of late years. The wholesale dealers usually put up the caviar in ¼-pound, ½-pound, 1-pound, and 2-pound cans for the retail trade.

EXTENT OF THE INDUSTRY IN 1897.

The following tables show in detail the extent of the sturgeon industry for the year 1897. About 120 kegs of caviar put up by dealers are not included in the tables, as the fishermen sold the fish in round condition to the dealers. Most of the Salem County fishing is carried on in Cumberland County, but the catch, etc., has been credited to the county in which the fishermen live.

Table showing the number of men employed in the sturgeon fishery of the Delaware River and Bay in 1897.

States and counties.	Fishermen.	Transporters.	Shoresmen.	Total.	States and counties.	Fishermen.	Transporters.	Shoresmen.	Total.
Pennsylvania:					New Jersey:				
Delaware	12			12	Burlington		2		2
					Salem	434	10	50	494
Delaware:					Cumberland	196	25	13	234
Newcastle	202	8	17	227	Cape May	54			54
Kent	74			74					
Sussex	6			6	Total	684	37	63	784
Total	282	8	17	307	Grand total	978	45	80	1, 103

Table showing the shore property and nets employed in the sturgeon fishery of Delaware River and Bay in 1897.

States and counties.	Shore property.	Drift gill nets.			States and counties.	Shore property.	Drift gill nets.		
		No.	Length, yards.	Value.			No.	Length, yards.	Value.
Pennsylvania:					New Jersey:				
Delaware	$50	6	5, 250	$580	Salem	$5, 620	217	102, 080	$15, 320
					Cumberland	39, 405	98	43, 870	6, 145
Delaware:					Cape May	1, 760	20	12, 100	1, 510
Newcastle	3, 356	118	64, 300	11, 435					
Kent	595	37	24, 600	3, 280	Total	46, 785	335	168, 050	22, 975
Sussex	85	3	2, 700	360					
					Grand total	50, 871	499	264, 900	38, 630
Total	4, 036	158	91, 600	15, 075					

Table showing the vessels and boats used in the sturgeon fishery of Delaware River and Bay in 1897.

States and counties.	Lay and transporting vessels.				Sailboats.		Rowboats.		Scows.		House boats.		Naphtha launches.	
	No.	Tons.	Out-fit.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Pennsylvania:														
Delaware	....	......	......	....	6	$475	....	......	....	....	....	......	....	......
Delaware:														
Newcastle	3	78	$165	$3,100	94	10,700	11	$200	3	$2,600	....	......	....	......
Kent	2	21	25	900	37	3,600	....	......	1	2,000	....	......	....	......
Sussex	1	46	......	1,500	3	375	1	25	....	....	....	......	....	......
Total	6	145	190	5,500	134	14,675	12	225	4	4,600	....	......	....	......
New Jersey:														
Burlington	1	11	50	700	....	......	....	......	....	....	....	......	....	......
Salem	11	282	485	15,900	218	40,815	....	......	3	1,800	10	$600	....	......
Cumberland	13	247	788	15,050	93	17,620	5	98	5	1,500	4	325	1	$700
Cape May	....	......	......	....	20	2,500	....	......	....	....	....	......	....	......
Total	25	540	1,323	31,650	331	60,935	5	98	8	3,300	14	925	1	700
Grand total	31	685	1,513	37,150	471	76,085	17	323	12	7,900	14	925	1	700

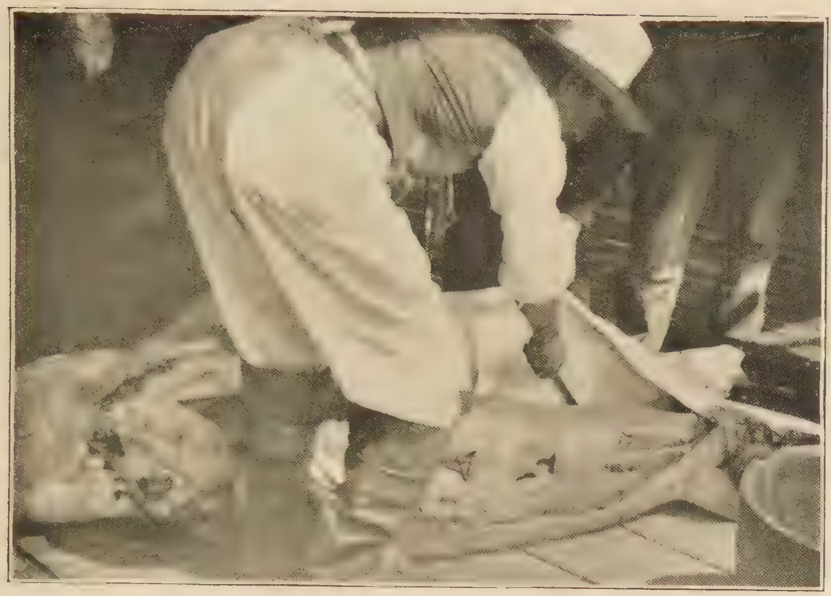
Table showing the quantity of sturgeon caught and caviar prepared on the Delaware River and Bay in 1897.

State and county.	Sturgeon.				Caviar.		
	No.	Round weight.	Dressed weight.	Value.	No. of kegs.	Pounds.	Value.
Pennsylvania:							
Bucks	*7	985	591	$53	....	....	....
Delaware	56	8,960	5,376	207	....	....	....
Total	63	9,945	5,967	260	....	....	....
Delaware:							
Newcastle	1,838	312,300	187,380	5,638	341½	46,103	$17,075
Kent	795	143,100	85,860	2,905	162	21,870	8,100
Sussex	66	11,850	7,110	471	11	1,506	561
Total	2,699	467,250	280,350	9,014	514½	69,479	25,736
New Jersey:							
Burlington	*2	300	200	8	....	....	....
Camden	*3	1,000	668	25	....	....	....
Salem	5,055	1,301,226	495,806	16,568	909	122,715	40,905
Cumberland	2,145	547,915	243,925	6,240	472½	63,760	21,253
Cape May	396	100,980	31,750	1,587	52	7,020	2,844
Total	7,601	1,951,421	772,349	24,428	1,433½	193,495	65,002
Grand total	10,363	2,428,616	1,058,666	33,702	1,948	262,974	90,738

* Taken incidentally in seines.

During the season of 1898 the New Jersey fishermen caught 5,060 sturgeon, valued at $19,375, while they prepared 1,067 kegs of caviar, valued at $76,861. As the fisheries of Delaware and Pennsylvania were not canvassed for the year 1898 it is impossible to show the catch for those States.

It is estimated by a leading dealer that during the season of 1899, only 700 kegs of caviar were put up by all the Delaware Bay and River fishermen.



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